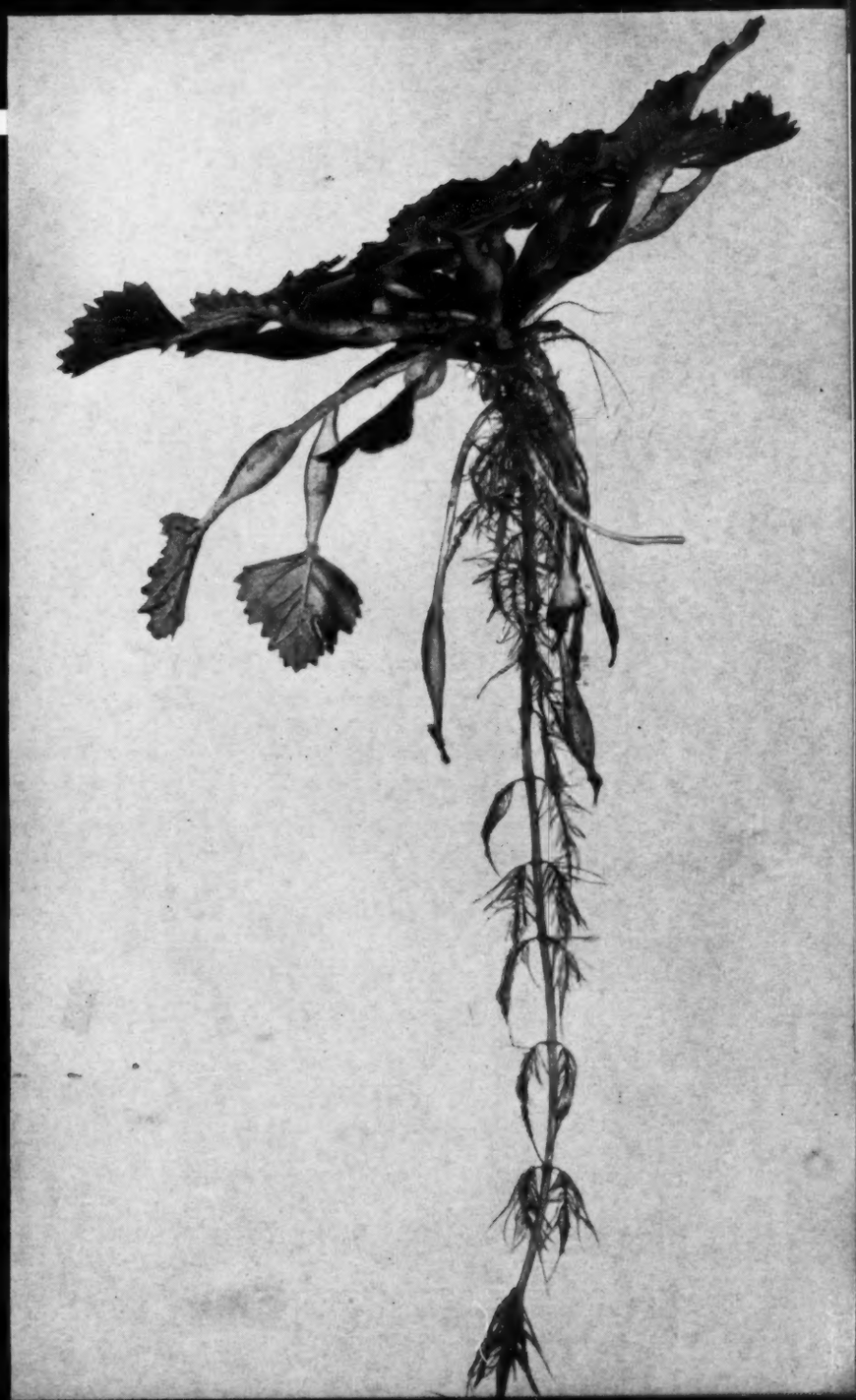
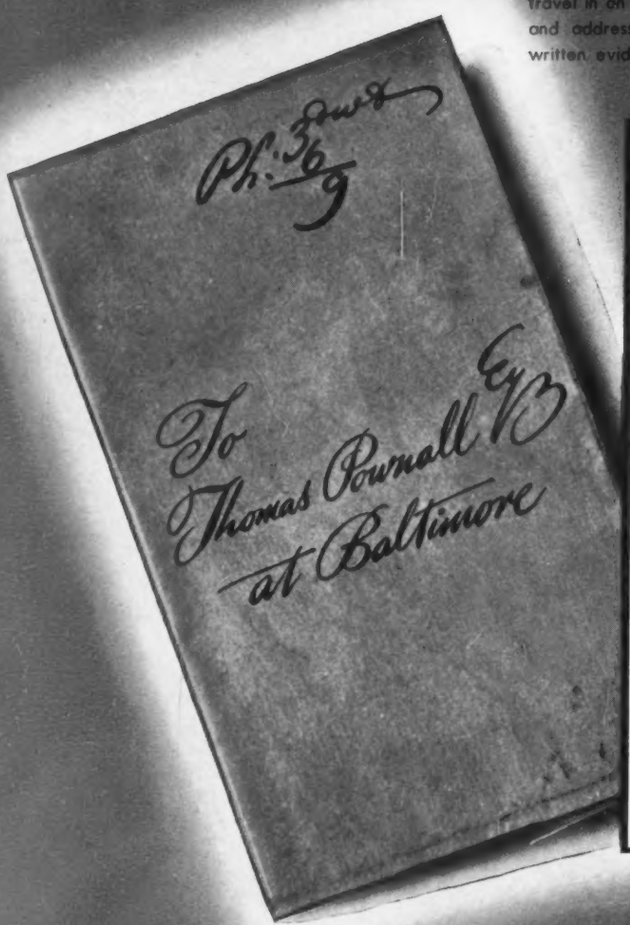
WATER WORKS & SEWERAGE





A typical letter of Franklin's time. It did not travel in an envelope, but was merely folded and addressed. Instead of a stamp, it bore written evidence that the postage had been paid.

URGENT! IMPORTANT!

Return empty chlorine cylinders promptly

Chlorine production for WAR and PUBLIC HEALTH needs is hampered by idle, unreturned cylinders. Our supply of new cylinders is limited—help us make full use of those we have. Return empty cylinders *without delay!*

"PHILADELPHIA TO BALTIMORE IN TWO DAYS! . . . INCREDIBLE, MR. FRANKLIN"

FOR twenty-one years before the Revolutionary War, Benjamin Franklin was deputy postmaster general of the American Colonies. It was he who first put the postal service on a paying basis. He did so by increasing the number and speed of riders . . . by measuring the post roads and marking them accurately with milestones . . . by careful attention to details.

In business, attention to the little things is tremendously important. Penn Salt's scrupulous care with details enables it to manufacture improved chemical products . . . helps its technical representatives to solve troublesome problems for customers . . . makes its nation-wide sales organization efficient. Yes, emphasis on "tremendous trifles" underlies Penn Salt in all its activities.

FOR DEFENSE BUY UNITED STATES SAVINGS BONDS AND STAMPS

PENNSYLVANIA SALT MANUFACTURING COMPANY

1850 *Chemicals* 1942

1000 WIDENER BUILDING, PHILADELPHIA

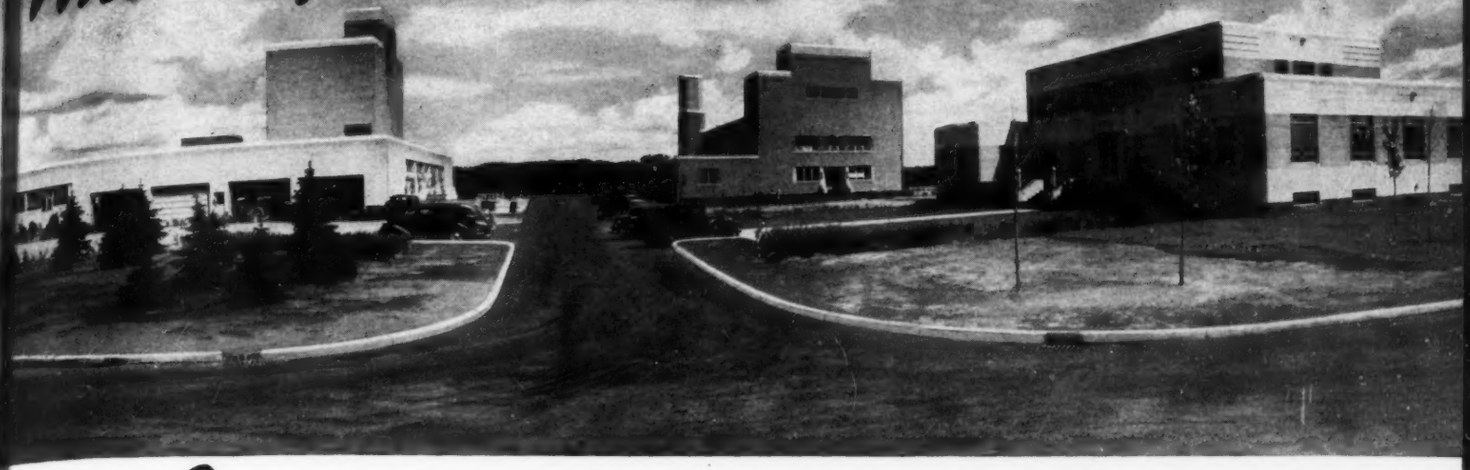
CHEMISTRY IS THE KEYSTONE OF INDUSTRY

BRANCH OFFICES: NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • WYANDOTTE • TACOMA

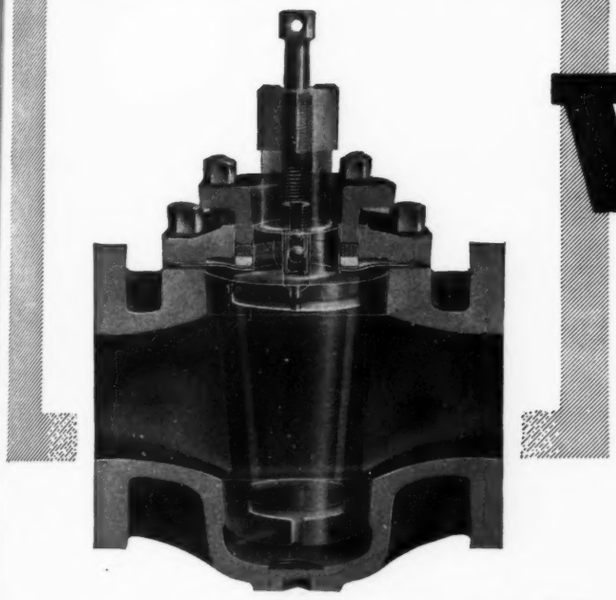
PLANTS: Philadelphia • Easton • Natrona • Wyandotte • Tacoma • Portland, Ore.

IN SEWAGE PLANTS SUCH AS THIS

Where Experience Writes the Specifications



It's NORDSTROM LUBRICATED PLUG VALVES



SANITATION engineers, who realize fully the severe field conditions under which valves must operate dependably in sewage disposal systems, invariably write Nordstrom Lubricated Plug Valves into construction specifications. Nation-wide use in municipal plants has definitely proved that quick quarter-turn operation, and 100% efficiency, even under most difficult conditions of corrosion and abrasion, place Nordstroms head and shoulders above other types for meeting the stiff requirements of sewage treatment. Nordstroms not only outlive other valves several times over, but the lubricated plug valve principle makes them vastly superior in successfully coping with the heterogeneous nature of the fluids which must be handled. It is in no way surprising, then, that for reasons of economy, efficiency and dependability, Nordstrom Valves figure prominently in the construction of today's most modern sewage plants.

We'll gladly send you illustrated literature, giving complete details concerning Nordstrom Lubricated Plug Valves for Sewage Disposal Plants. Write today.

TO ACCURATELY MEASURE GAS AND WATER
use
EMCO SEWAGE GAS METERS
and
PITTSBURGH HOT OR COLD WATER METERS

PITTSBURGH EQUITABLE METER COMPANY

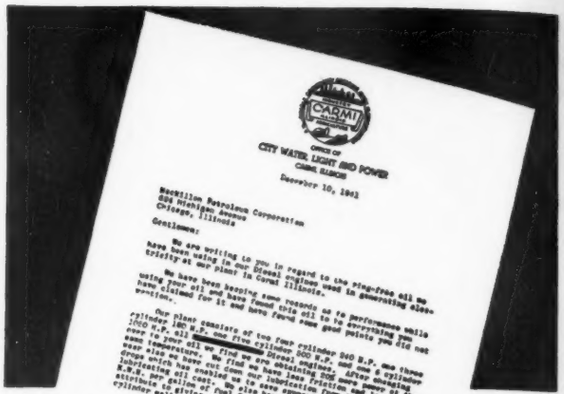
NEW YORK · BROOKLYN · DES MOINES · MEMPHIS · OAKLAND · TULSA · CHICAGO · BOSTON

MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.
NATIONAL METER DIVISION, Brooklyn, N. Y.

KANSAS CITY · PHILADELPHIA · SAN FRANCISCO · LOS ANGELES · SEATTLE · HOUSTON · COLUMBIA · BUFFALO

20% more power

Everything we claimed for it, plus good points we did not mention


CARMI
OFFICE OF
CITY WATER, LIGHT AND POWER
CARMI, ILLINOIS
December 10, 1941
Macmillan Petroleum Corporation
624 Michigan Avenue
Chicago, Illinois
Gentlemen:
We are writing to you in regard to the ring-free oil we have been using in our Diesel engines used in generating electricity at our plant in Carmi Illinois.
We have been keeping some records as to performance while using your oil and have found some good points you did not mention.
Our plant consists of two four cylinder 660 H.P. one three cylinder 450 H.P. and one five cylinder 600 H.P. one 4 cylinder 1000 H.P. all Diesel engines.
We have found we are obtaining more power at the same temperature, less friction and less cylinder wear.
Before using your oil we had to use 5 drops per minute on the lubricating system. Now we find we can operate with 3 drops per minute and have cut down our lubrication from 5 drops to 3 drops, saving 15% to 18% on the lubrication oil cost.
We also have found we can save considerable on fuel from the fact that we have raised the K.W.H. per gallon of fuel from approximately 11.5 to 11.9.
We wish to take this opportunity to say that if at any time you should have any customer doubting your representation of this oil, have them get in touch with us and we will show them the things we have found by actual use. Again thanking you for this oil
Yours truly
CITY WATER, LIGHT & POWER
William C. Huber
Sup. Pwr.

THE CITY OF CARMI, ILLINOIS, keeps careful records in its Generating Plant. They have five Diesel engines of various horse-power.

After telling us that with **RING-FREE** they are obtaining 20% more power at the same temperature, less friction and less cylinder wear, they write that they have cut down their lubrication from 5 drops to 3 drops, saving 15% to 18% on the lubrication oil cost.

They have also raised the **K.W.H.** per gallon of fuel from approximately 11.5 to 11.9.

"If at any time you should have any customer doubting your representation of this oil," they say, "have them get in touch with us and we will show them the things we have found by actual use."

RING-FREE is the only oil you need for *all* lubricating work.

What **RING-FREE** has done for others it can do for you. Won't you please write us?

MACMILLAN PETROLEUM CORP.
50 West 50th St., New York • 624 So. Michigan Ave., Chicago • 530 West 6th St., Los Angeles

MACMILLAN
RING-FREE
MOTOR OIL

Copyright 1942 by
Macmillan Petroleum Corporation

New HORTON ELEVATED TANK *Meets Airport Needs*

• **Aviation training centers, like municipalities, need modern water supply facilities to meet requirements for general service as well as for sprinkling. An example of the part played by elevated storage for this type of service is illustrated by the new Horton tank installation at a Western Airport.**

The construction of this field included the installation of a gravity water system for general service and sprinkling. Supply is pumped from wells into a collecting tank, and from there into the 500,000-gal. elevated tank shown here. Two booster pumps are used, controlled by the level of the water in the tank. In this way, an adequate reserve to meet peak demands is always available.

To resist earthquake shock the tank is designed to resist a lateral or seismic force of 1/10th gravity.

CHICAGO BRIDGE & IRON COMPANY

Chicago.....2193 McCormick Bldg.	Birmingham..1586 North 50th Street	Philadelphia...1644-1700 Walnut St.
New York.3390 165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg.	Washington...632 Washington Bldg.
Cleveland..2262 Builder's Exchange	Houston.....5615 Clinton Drive	San Francisco.....1083 Rialto Bldg.

Plants at **BIRMINGHAM, CHICAGO, and GREENVILLE, PA.** *In Canada:* **HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.**

WATER WORKS & SEWERAGE, March, 1942. Volume 89. Number 3. Published monthly at 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States $2.00 per year; Canada $2.00 per year; Foreign $3.00 per year. Copyright, 1942, by Gillette Publishing Co. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

TODAY—*more than ever before*—
YOU NEED THE DEPENDABLE PURITY, UNIFORMITY AND QUALITY OF . . .

DIAMOND *Liquid* CHLORINE

BECAUSE Diamond Liquid Chlorine is made under rigid supervision and checked at frequent intervals during manufacture, you can rely absolutely on its uniformly high quality.

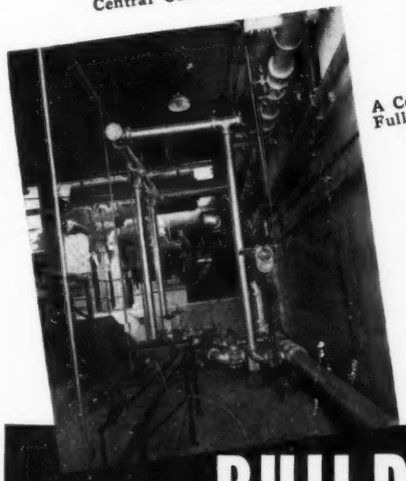
As a further guarantee of satisfaction, Diamond Liquid Chlorine always comes to you in tested containers of the type best suited to your requirements. For large users, 16- and 30-ton tank cars are provided; for moderate users, a multi-unit car delivers 15 one-ton containers; for smaller users, Diamond warehouses furnish 100-pound and 150-pound steel cylinders.

To make sure that *your* Liquid Chlorine is uniform, pure, dependable — SPECIFY DIAMOND!

DIAMOND ALKALI CO.
PITTSBURGH, PA., *and Everywhere*

The Attractive Plant and the Aeration Tanks.

Central Control and Instrument Board.



A Corner of the Fully-Equipped Interior.

A CITY CLEANS UP

For years, Cranston, R. I., with a population of 48,000, has been known as the biggest city in the country without a sewerage system; citizens preferred to point with pride to the school system!

Soon, however, this will all be forgotten for Cranston has undermined its streets with new sewers and the fine new treatment plant, illustrated here, is rarin' to go.

Type of Plant—Activated Sludge with separate digestion.

Capacity—5½ millions of gallons per day.

Engineers—Fay, Spofford & Thorndike.

Contractors—Jas. Monroe & Sons.

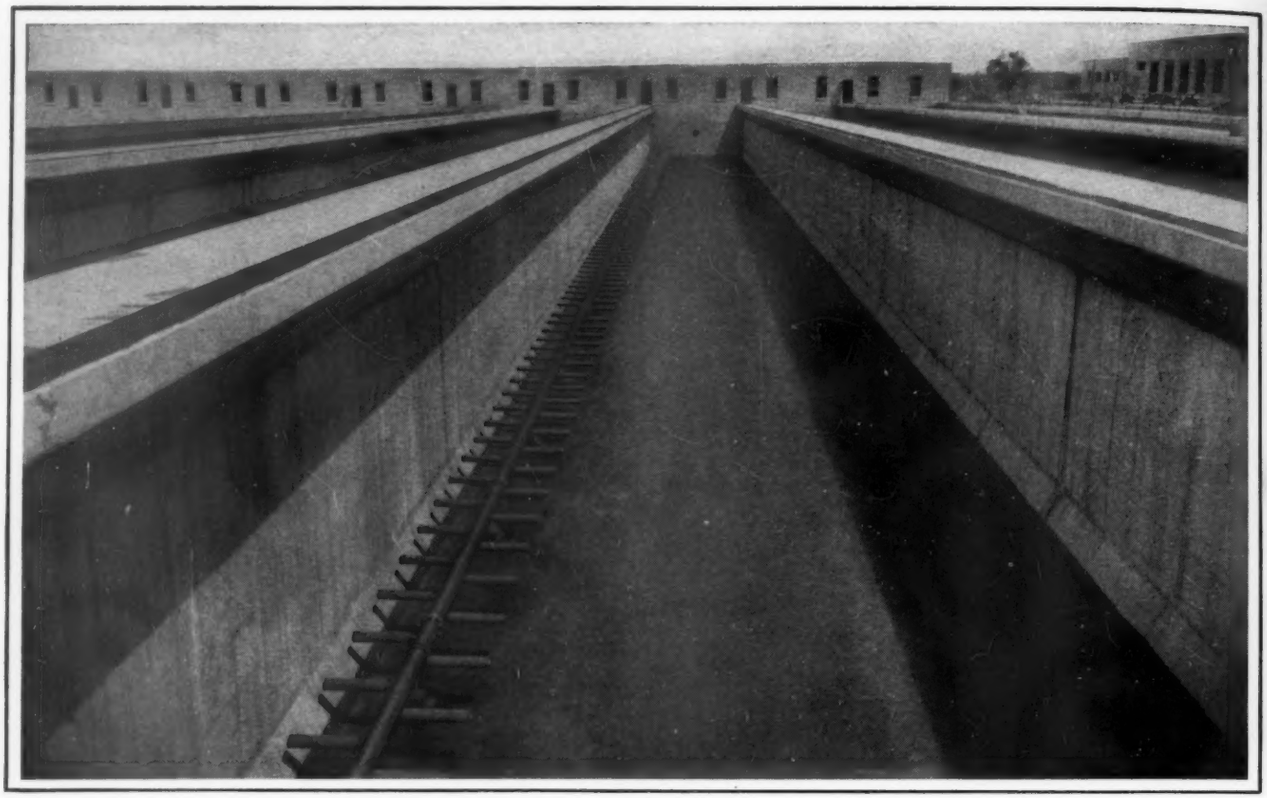
FLOW METERING AND CONTROLLING EQUIPMENT—BUILDERS, OF COURSE, to guide and record operating efficiency. Equipment includes Builders Venturi Sewage, Air and Sludge Meters; Air/Sewage and Sludge/Sewage Ratio Meters.

If you are planning a sewage treatment plant, for construction now or later, write for a copy of 24-page Bulletin 287; it will be a definite help.

BUILDERS-PROVIDENCE, INC.

(DIVISION OF BUILDERS IRON FOUNDRY)

PROVIDENCE . . . . . RHODE ISLAND



Here's a real
MONEY-SAVING TIP
ON DIFFUSED AIR AERATION

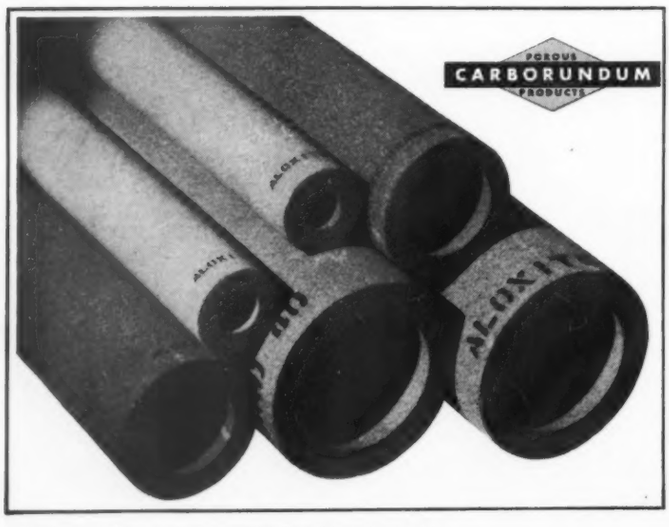
(Reading time—1 minute)

TWO years ago we publicized the fact that a "*wide distribution of air bubble diffusion gives most efficient aeration**" and that this could be accomplish d with Chicago Pump Company's diffuser tube system. Subsequent experience (a) supports this fact and illustrates a further benefit (b) of diffuser tube use:

(a) One notable example in an activated sludge plant shows 90% to 95% removal of BOD and suspended solids from a normal strength sewage using only 0.5 to 0.6 cu. ft. of air per gallon of sewage. And since the tubes are located about 2 feet above the tank bottom there is a further saving in power as compared to plate diffusion. Other examples are similar.

(b) Experiences have been reported recently on diffuser plate clogging at some of the older plants, especially where there is iron in the sewage. Cleaning of plates must follow in such cases and this is often expensive because of removal difficulty and breakage. It is obvious that *diffuser tubes*, which are assembled in place by a single bolt and can often be lifted from the sewage without dewatering tanks, are vastly more economical to service.

In consequence of the foregoing facts, here is the money-saving tip which you have probably guessed by this time—use Aloxite Brand Diffuser Tubes installed as a part of Chicago Pump Company equipment.



*Forceful Facts on Sewage Aeration by Air Diffusion No. 20—Write for pamphlet giving the full series of "Forceful Facts."

THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.

Niagara Falls, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

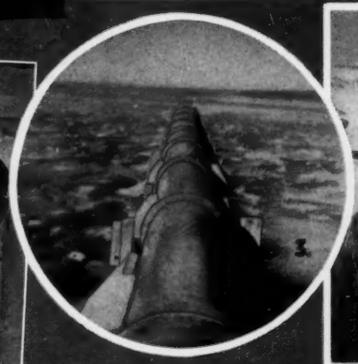
{ Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Co. }

Know any other

Bell and Spigot Jointing Compound THAT COMBINES ALL THESE ADVANTAGES?

HIGH SPEED PERFORMANCE • IMMUNITY TO MOISTURE • EASE OF HANDLING • CORROSION-PROOF • RESISTANCE TO MECHANICAL AND THERMAL SHOCK • CONSERVES LEAD—A STRATEGIC METAL

You'll get ALL these...and more... in *Tegul*-MINERALEAD



1—Part of the Wichita Water Supply Improvement referred to. Note pouring gates, which are chipped off after joint has been poured.

2—Heavy and fast highway and railroad traffic, and nearby industrial plants using heavy machinery entail constant vibration. Joints of *Tegul*-MINERALEAD can "take it". They stay tight even when laid on unstable ground. Think what this means in keeping down maintenance expense and service interruptions.

3—This California *Tegul*-MINERALEAD-jointed pipe drains into the Pacific. Sea water and the battering of 730 tides a year for more than decade haven't impaired the joints.

4—Temperatures from Zero to 36 below may make work with some compounds downright tough. But they don't bother *Tegul*-MINERALEAD. At the thermometer's other extreme, *Tegul*-MINERALEAD is probably the only practical compound used in overhead lines carrying hot water.

In terra cotta and concrete sewer pipe, *Tegul*-MINERALEAD joints are acid-proof and root-proof.

***Tegul*-MINERALEAD is a plasticized sulphur-base compound of low shrinkage and low coefficient of expansion. The addition of olefin polysulphide to its sulphur base adds extraordinary resistance to mechanical shock and temperature changes.**

Economies that cut pipe laying costs

***Tegul*-MINERALEAD** comes in 10 lb. ingots, making it easy to handle, ship and store. Correctly mixed at our factory, no amount of rough riding in transit can change its composition by shaking down its heavier components. ***Tegul*-MINERALEAD** weighs only 1/5th as much as lead and is put up five ingots to carton. Thus it promotes saving in shipping space and freight costs. It melts without sediment and doesn't settle in the pot, needs no skilled labor, caulking or deep bell holes and, since the ingot is impervious to moisture, it may be stored outdoors in any weather.

Trenches need not remain open waiting for that initial leakage to seal. Immediate backfilling does away with the traffic hazards incidental to main laying.

***Tegul*-MINERALEAD** melts, pours and sets with speed that hastens the job and cuts labor costs. It works uniformly with pipe from 4″ to 48″ diameter.

Plan now to attend the
AMERICAN WATER WORKS ASSOCIATION CONFERENCE ON WARTIME WATER WORKS PROBLEMS
At the Stevens Hotel, Chicago
June 21—25, 1942

IN A RECENT LARGE INSTALLATION

Leakage Specifications allowed *100* Gallons per inch, per mile • *Tegul*-MINERALEAD *allowed only 39*

Among outstanding projects in which ***Tegul*-MINERALEAD** has figured is the Wichita (Kansas) Water Supply Improvement of 1939-1940. 33 miles of Bell and Spigot line were laid over prairie country, including 22 miles of 48″ diameter pipe (the rest being 42″ to 14″). Job was completed in nine months of working time. While engineer's specifications allowed for maximum leakage of 100 gallons per inch, per mile, actual leakage within two weeks after water was turned into the line was only *39* gallons per inch, per mile. In this project 325,000 lbs. of ***Tegul*-MINERALEAD** were used.

***Tegul*-MINERALEAD's** further advantages include low cost of installation and maintenance.

Why not, right now, dictate a request for ***Tegul*-MINERALEAD** literature? Or, address the nearest Atlas representative, technically trained and able to discuss your problem and give helpful advice.

Tegul-MINERALEAD

THE House of Jointing Materials — THE ATLAS MINERAL PRODUCTS CO. OF PA. MERTZTOWN PA EST 1892

THE Atlas Mineral PRODUCTS COMPANY OF PENNA.

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175 Spring St., S. W.

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*DETROIT, Michigan
2970 W. Grand Blvd.

*KANSAS CITY, Kansas
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PITTSBURGH, (10) Pa.
Old Boston Road

TORONTO, Ontario
McRae Engineering Equipment, Ltd.
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The ATLAS MINERAL PRODUCTS Company of CALIFORNIA — Redwood City, California

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817 Yale Street

*SEATTLE, Washington
1120 Eighth Avenue, South

*Stocks carried at these points

ACIPCO MATERIAL for *U. S. DEFENSE*

Many thousand tons of Cast Iron Pipe have been furnished by this Company for army camps, cantonments, forts, naval stations and industrial operations directly connected with production of war and defense materials. Miscellaneous castings are also being manufactured by this Company for use in national defense.

For wartime emergency breaks in pipe lines, a Doublex Simplex Split Sleeve will enable you to make quick, economical, effective repairs. You should have a supply of several of each different size that you might need. Thousands in use, some for 13 years. Order now from nearest shipping point — Birmingham, Dallas, Kansas City, Los Angeles, Minneapolis, San Francisco, Pittsburgh.

AMERICAN CAST IRON PIPE COMPANY

Birmingham, Alabama

New York City	Chicago	Kansas City	Minneapolis	Houston
Pittsburgh	Cleveland	Dallas	Los Angeles	San Francisco

PERMUTIT* equipment at the JACKSONVILLE NAVAL AIR STATION

Schematic Description. Water supply at the Main Base comes from wells, contains considerable hydrogen sulphide and averages 14 grains hardness per gallon.

Permutit De-gasifiers first remove the hydrogen sulphide, after which all water used at the base is softened to 5 grains per gallon, by two fully automatic Permutit zeolite softening plants, each of one million gallons daily capacity.

The 5-grain water is then softened to zero where required for boilerfeed . . . at each of two power plants by two fully automatic Permutit zeolite softeners. Part of this zero water is diverted to the main laundry.

Two Permutit manual zeolite units soften the water at the power plant serving the hospitals, and a fully automatic zeolite water softener serves the hospital laundry.

The water at four swimming pools is treated by complete Permutit re-circulating equipment, and three other pools under construction are to be similarly equipped.

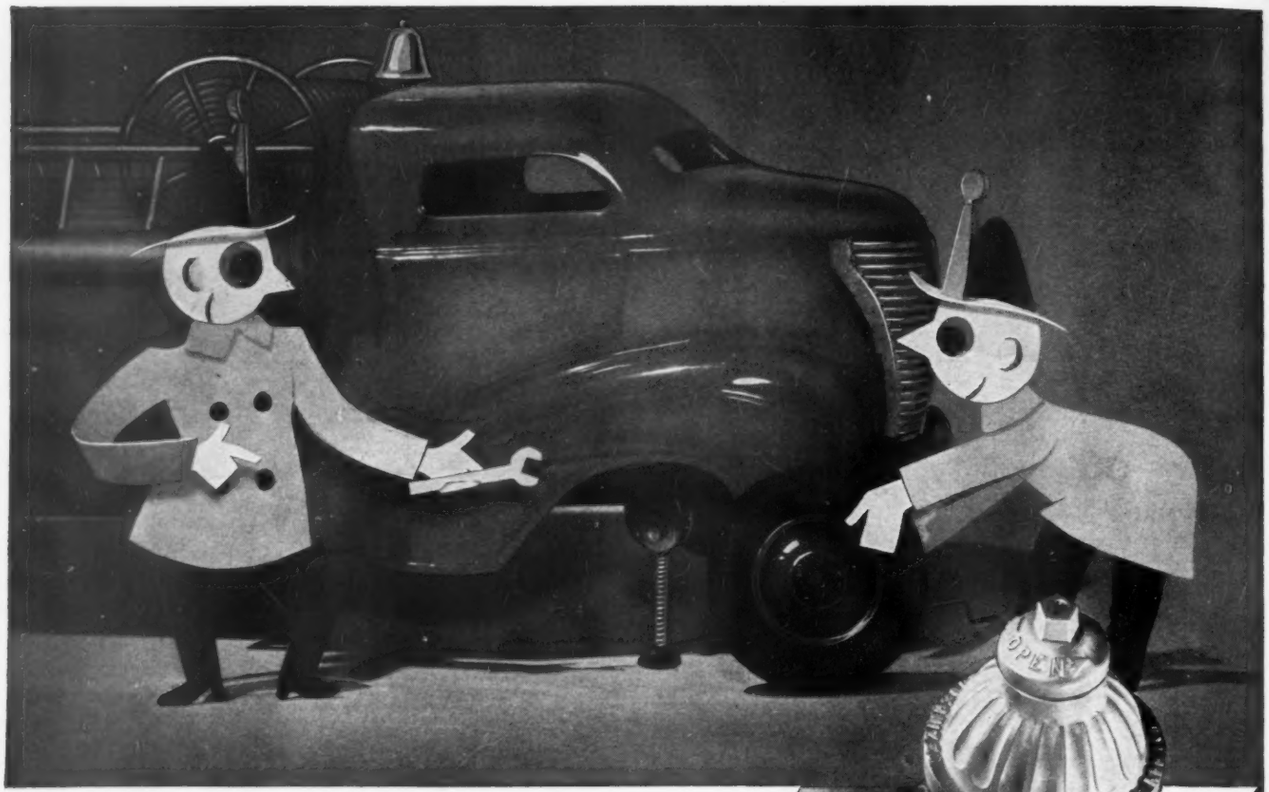
Permutit is the world's largest manufacturer of water conditioning equipment—makes every type. Why not let Permutit help you solve *your* water problem? Write for free booklets: The Permutit Company, Dept. G1, 330 West 42nd Street, New York, N. Y.

*Trademark Reg. U. S. Pat. Off.

In Canada, call upon the Permutit Company of Canada, Ltd. . . . Montreal . . . Toronto . . . Winnipeg . . . Calgary

PERMUTIT

WATER CONDITIONING HEADQUARTERS



"EASY AS FIXING A MATHEWS HYDRANT, ISN'T IT?"

Changing a tire and replacing a Mathews Hydrant are very much alike. Just remove the "works" and replace it with a spare. In a Mathews Hydrant the barrel contains all working parts including main and drain valve seats. It unscrews from the elbow, lifts out through the loose protection case and means that *you never have to dig a properly set Mathews Hydrant.* Fire protection is vital in war time. Give your community the speedy repair, the frost protection, the absolute dependability, and the permanent economy of Mathews Hydrants.

MATHEWS HYDRANTS

Made by R.D. WOOD Company

400 CHESTNUT STREET, PHILADELPHIA, PA.

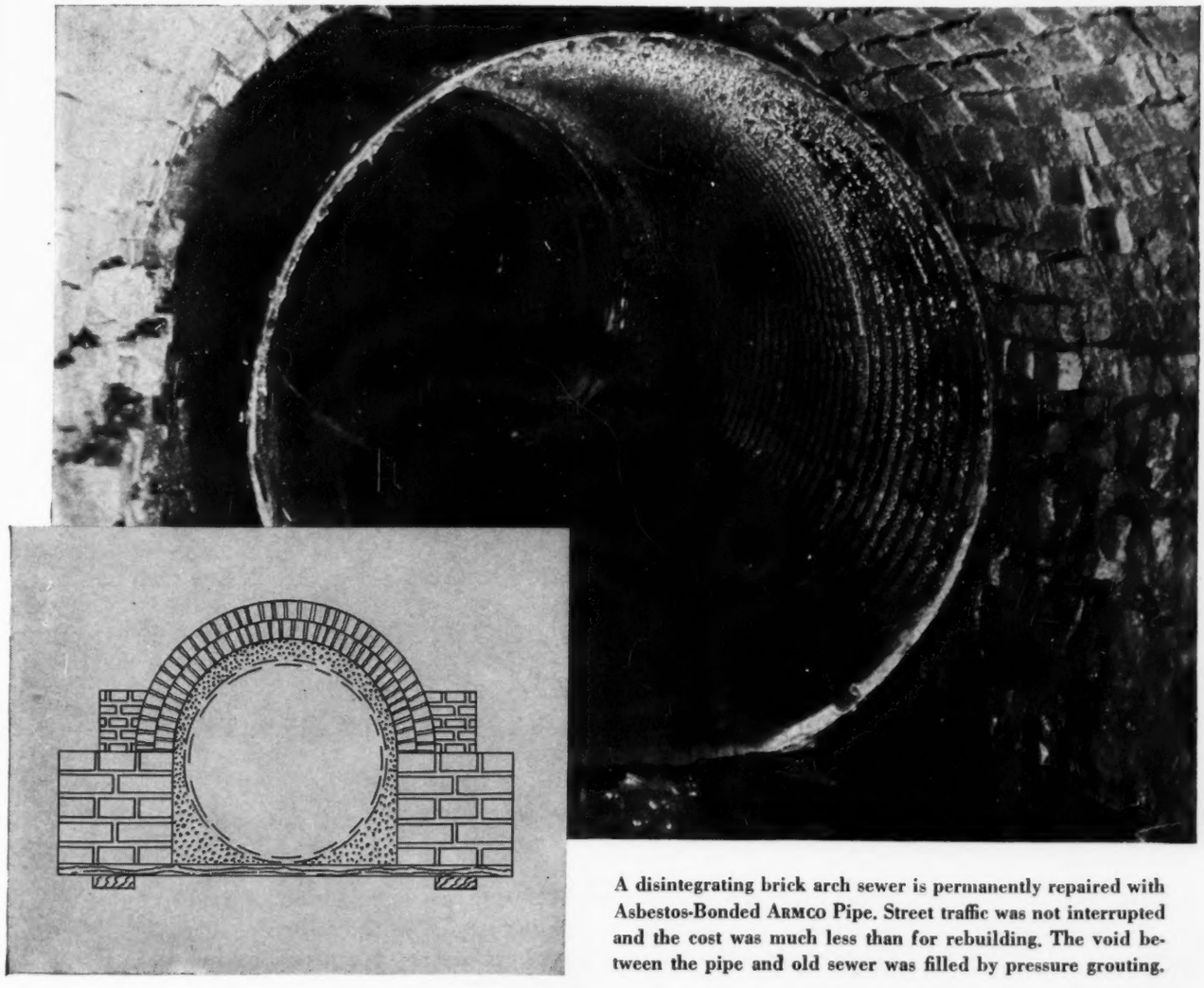
ESTABLISHED IN 1803

GIVE FAILING SEWERS
A New Lease on Life

• When old sewers get out of hand here's a practical answer. Specify Asbestos-Bonded ARMCO Sewer Pipe. This way you stop excessive maintenance and get a permanent job at less than half the cost of building a new sewer.

ARMCO Pipe meets every War Time requirement. Flexible corrugated metal is shatterproof and eliminates breakage. Tight joints reduce the danger of infiltration. Long lengths and fewer joints mean lower installation costs. Cradling is unnecessary. Fully as important, ARMCO Pipe brings assurance of long material life. The metal is durable ARMCO Ingot Iron, service-proved by 36 years of underground performance. Now a thick bituminous pavement in the bottom, and full bituminous coating bonded to the pipe, bring added protection.

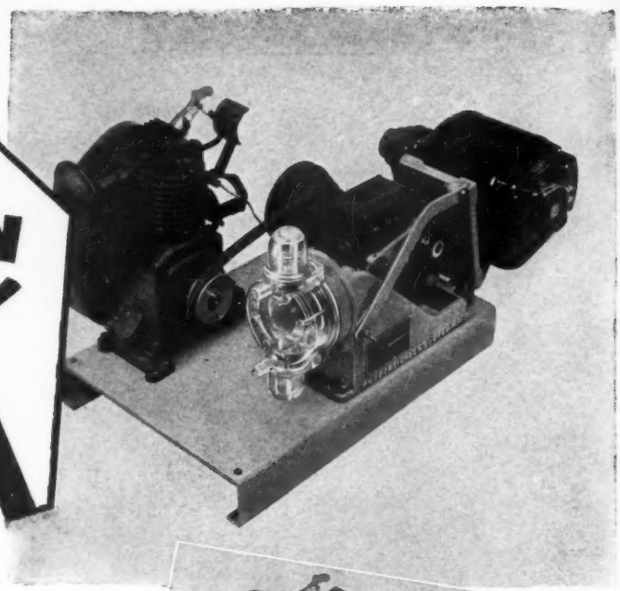
Use Asbestos-Bonded ARMCO Sewer Pipe for economical repair work or new construction. Your request will bring complete data. ARMCO DRAINAGE PRODUCTS ASSN., 315 Curtis St., Middletown, Ohio.



A disintegrating brick arch sewer is permanently repaired with Asbestos-Bonded ARMCO Pipe. Street traffic was not interrupted and the cost was much less than for rebuilding. The void between the pipe and old sewer was filled by pressure grouting.

Asbestos-Bonded ARMCO SEWER PIPE

EMERGENCY STERILIZATION *ANYWHERE!*



Every Water Works, regardless of size, can afford this inexpensive emergency equipment.

Because a Dual Drive Chlor-O-Feeder can serve as a permanent chemical feeder and as a portable emergency chlorinator for:

EMERGENCY CHLORINATION—to sterilize breaks, new mains, dead ends, floating reservoirs, and remote sections.

STANDBY CHLORINATION—to augment gas chlorinators during emergency overload periods or to replace them during repairs.

Fig. 1—Heavy Duty Dual Drive Chlor-O-Feeder for pressures up to 85 lbs. Approx. $330.00 delivered to your plant.

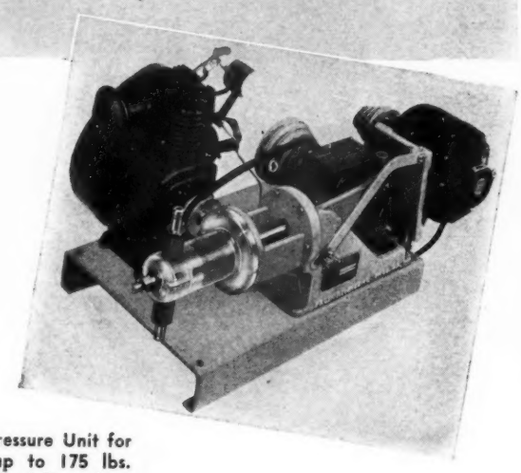


Fig. 2—High Pressure Unit for pressures up to 175 lbs. Approx. $370.00 delivered to your plant.

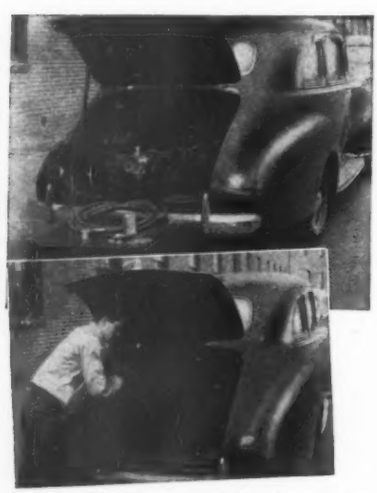


Fig. 3 and Fig. 4—Portable Emergency Unit fits easily in trunk of car.

If you need emergency sterilization equipment check these Dual Drive Chlor-O-Feeder advantages:

1. FEEDS OVER 100 LBS. CHLORINE PER DAY.
2. ANY PRESSURE UP TO 175 LBS.—no booster pump required.
3. PORTABLE — LIGHT — EASY to HANDLE — See photos.
4. FEEDS ANY WATER-WORKS CHEMICAL.

FREE — **Write today for your copy of "Emergency Sterilization Equipment" describing applications and advantages of Dual Drive Chlor-O-Feeders. If ordering send your best priority for prompt shipment.**

%PROPORTIONEERS, INC.%

Emergency Chemical Feeder Headquarters

9 N. CODDING ST. PROVIDENCE, R. I.

WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Operating Experiences at Gary, Ind."

Is a worthy report of operating experiences at the new activated-sludge plant of Gary, Indiana, during a period of more than a year. This plant, producing its own power from digester gas and designed to handle ground garbage, has several novel design features. Even without the aid of garbage solids to amplify the supply of gas for the engines, the ability of the Gary plant to operate efficiently on its own power, solely, but for a short period of the year constitutes one operating experience of marked economic importance; the economical use of air representing another. The authors—
L. R. HOWSON, Designing Engineer,
and
W. W. MATTHEWS, Plant Superintendent.

"Repairs and Maintenance in Small Water Works."

Is an article chock full of timely ideas and suggestions for the small water utility operator. We might add that it will also bear study by those connected with operation and maintenance of the larger plants. This is one of those rare and highly useful articles for operators and particularly is this so at the present time. The author—
GUY A. RHOADS, Manager,
Public Utilities of Safford, Arizona.

"Licensing Dangers"

Constitutes a discussion of the good and the bad features of water works operator licensing practice in the form that such is being advanced in this country. The author issues a note of warning to operators concerning the dangers which beset them in accepting licensing acts over which operators proper have little or no control. The author is—
JOSEPH E. YOUNG, Superintendent,
Water and Light, Fergus Falls, Minn.

"Complete Treatment of High Concentration Wastes."

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Miami Water & Sewer Dep't, Miami, Fla.

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FRANK C. AMSBARY, JR., Supt.,
Illinois Water Service Co., Champaign, Ill.

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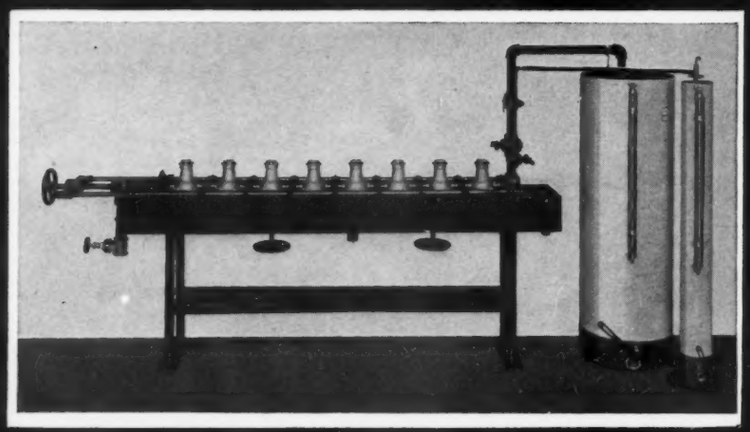

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WATER WORKS & SEWERAGE

VOL. 89, NO. 3 *A Gillette Publication* MARCH, 1942

THE CONTROL OF WATER CHESTNUT GROWTHS

By CAPTAIN MAXIM LIEBER
Sanitary Officer
FORT BELVOIR, VA.

THE water chestnut is an oriental plant introduced in this country either directly from the Far East or indirectly through Europe. Many versions exist as to the why and wherefore of its introduction to this continent, but the statements cannot be considered sufficiently authentic to be elaborated on.

This plant is called by various names, such as Shingoda, Bull Nut or Water Caltrop, the latter being the most popular and common terminology. Botanically, it is known as *Trapa Natans*. Although it grows luxuriantly in the Orient, the water caltrop is on the decline in continental Europe. It has, however, gained a foothold in various sections of the eastern United States, principally Saunders Lake, the Mohawk River, and the Barge Canal in New York State, in the back waters of the Potomac River, and in ponds here and there.

The water chestnut is an annual fresh-water plant which germinates in the spring from a nut deposited the previous year. Root-stems appear and grow to the surface. These stems may vary from two to fifteen feet in length, depending on the depth of the water. At the surface appear numerous rosettes of leaves. These leaves possess the familiar enlarged sac-like bulbs at their base which help buoy the plant on the surface (Fig. 1 and 2). During the latter part of June, a white flower appears on the under-surface of the rosette. This is followed by the growth of the caltrop nut, which matures by the latter part of July (Fig. 3). The plant usually dies during the latter part of August after the nut matures and falls to the river or lake bed. Being very prolific in growth, it took but three to four years to acquire the heavy growth at Fort Belvoir, Va., pictured in Fig. 4.

The Author
Holds Up a Specimen of Water Chestnut to Show Length of Root Stem.

As many as nine caltrop nuts may be counted on a water chestnut rosette. It is worth noting that in China the water chestnut is an important article of food, while in this country it is used in the preparation of those well known Chinese-American dishes—chop-suey and chow-mein. To the author's knowledge, the plants growing in the Potomac River are not used for this purpose.

The sanitary significance of this plant is its effect on streams and waterways receiving sewage effluents for disposal by dilution. This is particularly so in some regions on the Potomac River where municipalities subject their sewage only to primary treatment. Considering the density of the water caltrop, it is obvious that the nuisance caused by the organic wastes stagnated by these plants is unquestionably detrimental to public health. These waters liberate excessive odors of decomposition during the hot summer months. They also serve as ideal breeding areas for mosquitoes and have effected game fishing in this region. As can be seen from photographs at Fort Belvoir, this growth was extremely heavy over an area exceeding 1200 acres.

Methods of Eradication

Various methods for eradication of the water-chestnut have been attempted. They include chemical treatment, manual removal and machine cutting. Of these, the latter two were the only successful methods. The cutting machine proved to be the most economical.

Figure 6 shows the Hockney Cut-

ter, which was used in cutting the water caltrop in Dogue Creek at Fort Belvoir. It possesses a paddle propelling device in the rear and two twelve-foot horizontal cutting bars at the front. The forward edge of these bars resemble the teeth of a saw. In operation, one bar moves back and forth in a horizontal plane, cutting the stems of all vegetation in its path. The cutting blades may be submerged from one to five feet below the water surface. This machine can cut approximately a half acre per hour, depending on the thickness of growth.

Most Effective Cutting Period

The most practical period to cut this plant is during the months of May and June. At this stage of growth the stems are not sufficiently strong to interfere with the machine's cutting efficiency. In addition, the plants have not been given the opportunity to mature. This period of operation is extremely important. If the plant is severed from its anchorage during its mature stage, it will undoubtedly reseed the cut-over and uninfested areas.

Botanical studies made by the U. S. Botanical Survey indicate that many of the cut plants which have progressed sufficiently in growth are capable of maturing if left in the water. This naturally augmented the problem. With the dense infestation existing in Dogue Creek, it was realized that these plants must be pulled to shore and beached. The acquisition of CCC labor and the necessary boats and boatmen helped solve this difficulty.

The CCC men would inspect the surrounding shoreline for areas possessing flat hard bottoms. Large crude pens were constructed at selected points, into which boats would boom the cut plants. The pen would then be closed with a floating boom and the CCC men would haul the plants on shore. Figure 5 is a picture of these operations. It was advantageous to construct pens at various points on the creek. This enabled the booming crew to operate more efficiently by working continuously with the tide and wind.

Since 95 per cent of the plant is water, these cut growths are dried and killed with little difficulty in the hot sun. This treatment would require large drying beds which ordinarily are not present along a wooded shoreline. To circumvent this, the cut plants were placed in large heaps. It was noticed that while the surface layer of these piles dried as was anticipated, the underlying material was undergoing fermentation. Although the odors caused by this type of treatment cannot be considered as pleasant, their effects were far from being termed offensive. With these results, this method was considered satisfactory and was utilized for the final disposal of the cut plant.

After an area has been completely cut, an occasional plant may appear that year or the following season. These are termed as "Secondary Growths." They represent these plants which were too small to be cut by the Hockney machine or were the result of reseeding from the previous year's cut plants. These growths will be cut the following season and may be repeated a third time before an area can be considered rid of this nuisance.

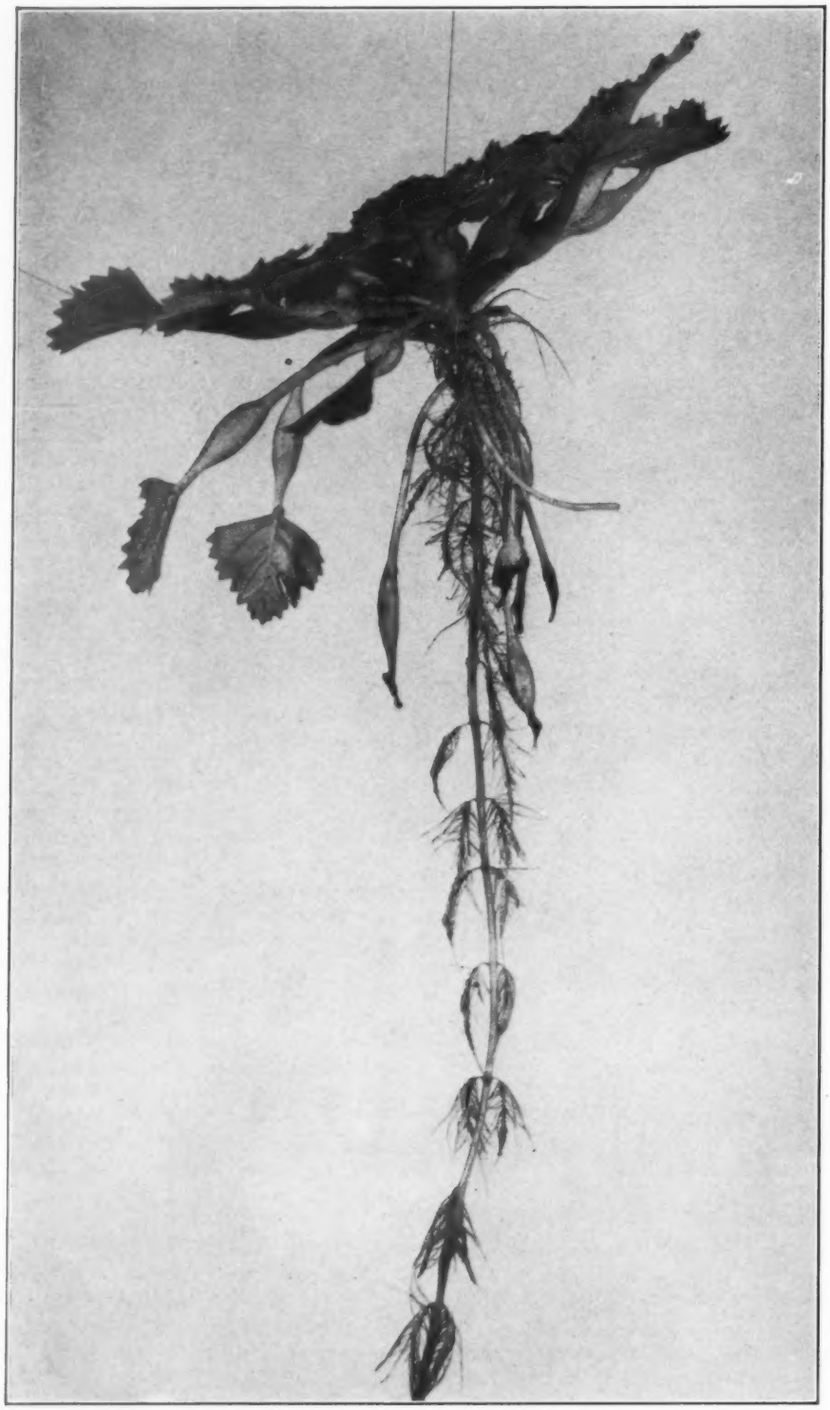

Fig. 1—Trapa Natans

(Otherwise the Common Water Chestnut. Food for the Chinese; a Nuisance for Us.)

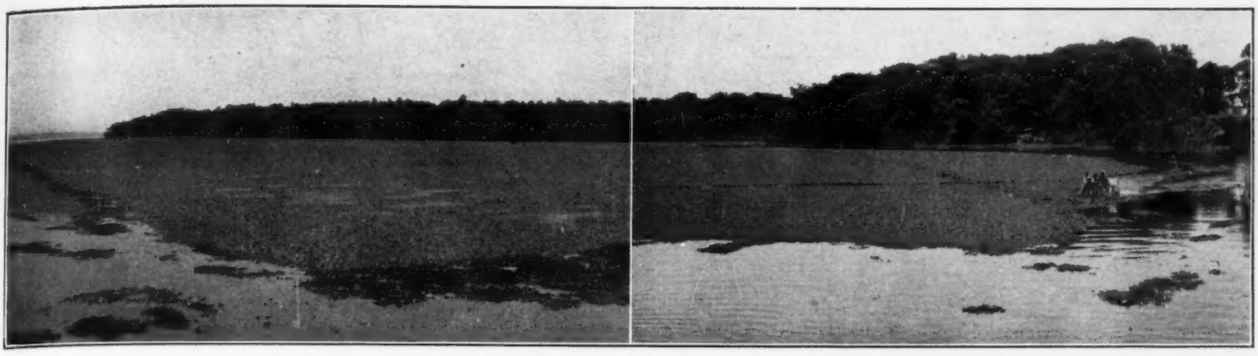

Fig. 3—Picturing the Growth of Water Chestnut to Be Removed

It was necessary to utilize manual labor for the removal of the water caltrop in the shallow shoreline waters unapproachable by the cutting machine. The cost of manual removal is high and the process is a slow one. However, its results have proven to be superior to any method thus far used. Secondary growths are less of a problem with this method of eradication.

A new Ponton School was constructed in the upper regions of Dogue Creek in the Fall, 1940, which at one time was infested with a heavy growth of water chestnut. Its construction necessitated the dredging of a substantial area. The caltrop nuts in this section were either removed or covered with a layer of fill before the sprouting season began. No growth occurred during the following season of 1941. This effective process may prove valuable in future eradication activities.

Chemical Methods Tried

Recent investigations in chemical treatment as a method of eradication produced results with promise. Such studies were begun the latter part of the caltrop season in 1941 at Fort Belvoir, Virginia. In choosing the chemical or mixture of chemicals for this work, it was decided that it should fulfill a three-fold purpose:

1. Be detrimental to the growth of the water caltrop plant.
2. Its concentration should not affect fish life.
3. If possible, it would be advantageous to have it act as a mosquito larvacide.

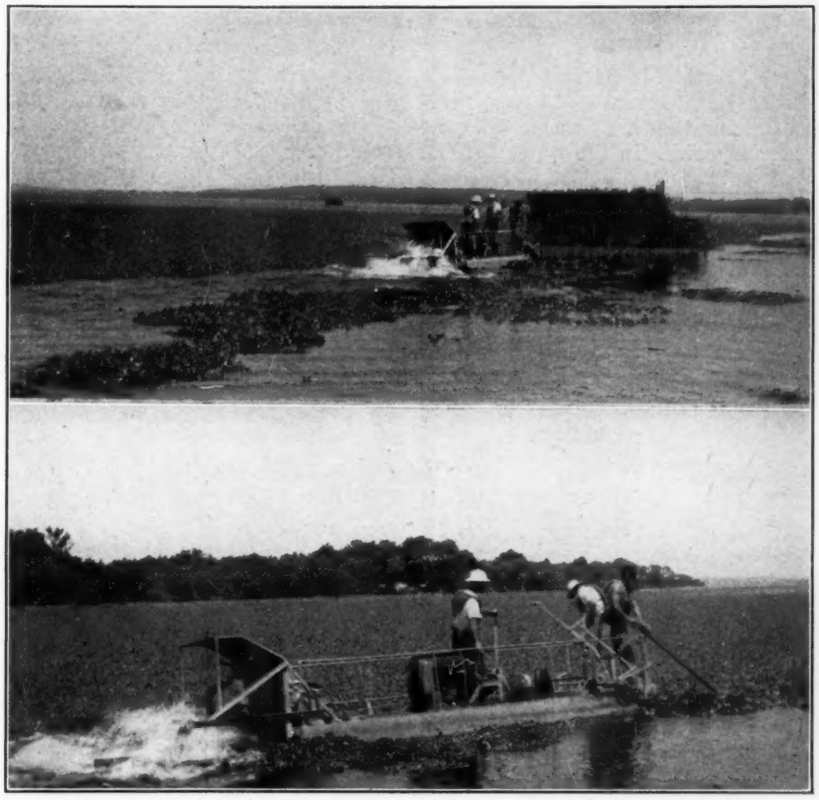

Fig. 2—Two Views of the Hockney Cutter at Work on the Water Chestnut
The two twelve-foot horizontal cutting bars working in front of the boat cuts all vegetation in their path, at depths of 1 to 5 feet beneath the surface as desired.

The powder used was a mixture of chemicals put out by the York Laboratories Company of York, Pa.,

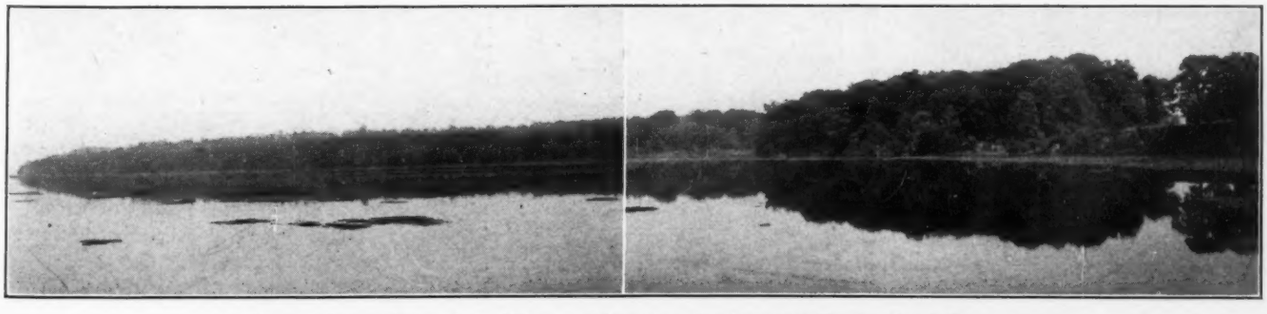

Fig. 4—Same Area as in Fig. 3. After the Cutting and Removal of Growth

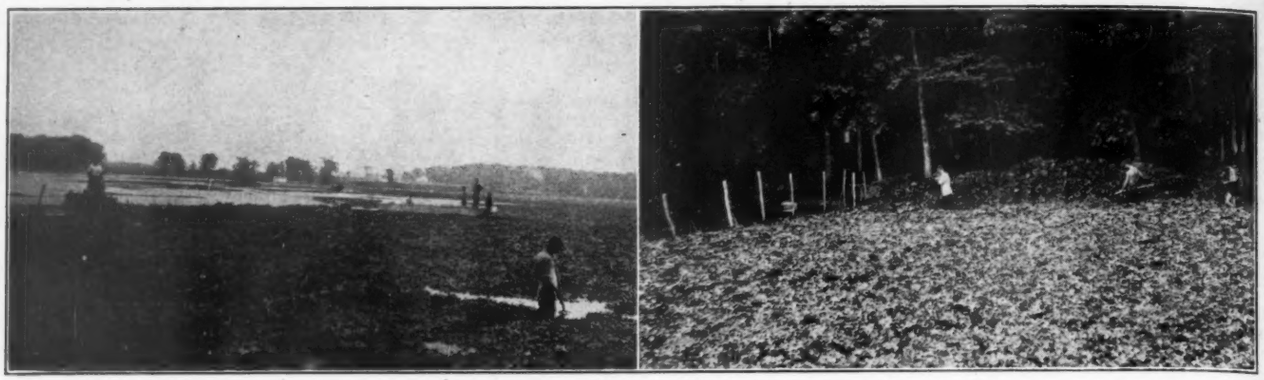

Fig. 5—Method of Removal of Cut Growth

(Left) Booming in the cut growth, the boom being wire fencing strung between the two boats. (Right) The growth confined in the shore-line pens for removal to the shore.

called "Herbicide-Larvacide." This powder has proven to be very successful in the eradication of the Water Hyacinth in the waters of the Southeastern and Gulf States. Its mosquito larvacidal properties is attributed to the presence of Paris Green in the mixture. The application of this powder over a section of caltrop infested water was facilitated by the use of a Savage Powder Duster, as illustrated in Fig. 6. Approximately two pounds of this powder was spread over an area of about 30 feet square.

Fig. 6—Method of Applying Chemicals During the Study of Eradication by Chemicals

Three days after the powder had been applied, the water caltrop acquired a dark brown color and the plants were decomposing in the water. This condition created a situation comparable to a stream containing unstable and putrecible material and caused the water to have a low dissolved oxygen content. The detrimental effect of this condition on fish life is self evident.

In future operations it may be possible to avoid the bad effects of the decomposing plants by booming them to shore before they deplete the dissolved oxygen in the water.

Summary

The introduction of the water caltrop in various sections of this country has assumed proportions to be considered a public health problem. Its stagnating effects on the tidal waterways have interferred with the disposal of sewage or sewage effluents by dilution and have created new breeding areas for mosquitoes. By the use of a Hockney Cutting Machine and manual removal, successful results were experienced in its eradication at Fort Belvoir, Va. Being a very prolific annual freshwater plant, the cut caltrop had to be boomed to shore before the caltrop nuts matured and reseeded these areas. This operation will have to be repeated on a second and perhaps a third consecutive season to eliminate the thin secondary growths. Investigations are being made for more practical and economical means of eradication.

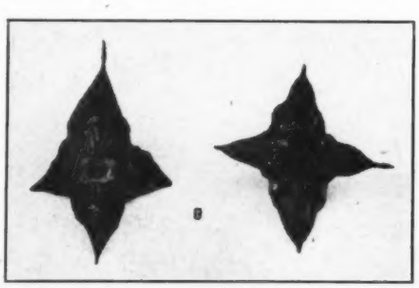

Fig. 7—The Mature Nut of the Caltrop
Picturing the Under and Upper Sides of the Nut.

Maintaining Public Relations During War Times

● Many water plants throughout the country have adopted the precautionary measure, during the present emergency, of barring all visitors from water treatment plants. Such policies directly affect educational groups such as high school classes, college classes, nurses, etc.

In order to maintain satisfactory public relations, it is suggested that water plant officials take advantage of movie films which describe water treatment processes in general. One such film entitled "Behind the Water Tap" is made available, without charge, to any water works official. This movie is on 16 mm. colored silent film and is shipped on three 400-ft. reels. Time of showing is about 35 minutes.

In requesting the loan of the film, it is desirable to specify alternative dates since requests will be handled in the order in which they are received.

Write to West Virginia Pulp and Paper Company, Industrial Chemical Sales Division, 35 East Wacker Drive, Chicago, Illinois.

THE ENSLOW CONTINUOUS STABILITY INDICATOR

Some Practical Notes on 1½ Years of Its Operation and Introducing the Durham "Contactor"

By ROBERT S. PHILLIPS
Chief Chemist
WATER AND SEWERAGE DEPARTMENT
DURHAM, NORTH CAROLINA

OUR laboratory, like many another throughout the country, was extremely interested in the "Convention-Floor" invention of Linn H. Enslow, editor of WATER WORKS AND SEWERAGE, which has come to be known as the Enslow Continuous Stability Indicator or Enslow Stabilizer. This instrument, streamlining the so-called "Marble Test," seemed to be the answer to the water works operator's need for a practical short-cut to determine the proper treatment to attain the equilibrium point of finished waters. With certain modifications, explained later in this article, this instrument has been, and is, able to accomplish all its inventor originally hoped for.

The Author

Following publication[1] of early designs, we constructed a Stabilizer similar to that suggested. We soon discovered, however, that fine Calcium Carbonate did not behave according to our preconceived notions. Explained simply: if water velocities in the Stabilizer were high enough to suspend the chalk, fine Calcium Carbonate would carry over into the Stabilizer effluent, if velocities were low enough to obtain a clear effluent, "packing" and consequent short-circuiting of the chalk resulted.

The problem, therefore, was one of finding a closed device which could be added to the system and which would provide an adequate contact period with the fine calcium carbonate without sweeping over chalk. In other words, a container was needed which would provide for both high and low water velocities under constant flow conditions. A conical vessel, having a relatively small cross-sectional area at its vertex and a large area at its base, would solve the problem, it was thought, if the water was introduced at the vertex. This idea was based on the same principle as that of the Spaulding Precipitator, and was suggested by one of our Durham chemists, now Captain L. A. Lubow, U. S. Army. For experiment a separatory funnel of 500 mls. capacity was employed with success. Here the relative water velocities, base to vertex, were approximately 75 to 1. Later a two-liter cone-shaped device was made available by one of the laboratory supply houses. We have continued to use the two-liter cone since that time and have tentatively named it the "Contactor."**

The "Contactor" provides intimate

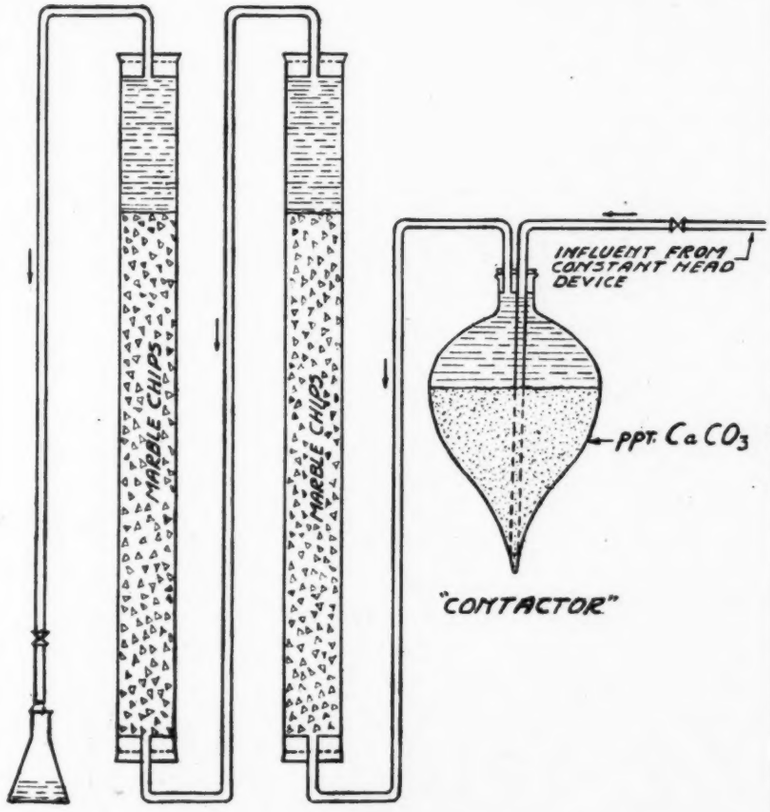

FIGURE 1. ENSLOW STABILIZER USED AT DURHAM, N.C.

Fig. 1.—The Original Enslow Stability Indicator to Which the Durham "Contactor" Has Been Added.

**Phipps and Bird, Inc., Richmond, Virginia, now manufactures an Enslow Stabilizer which includes the Durham "Contactor."

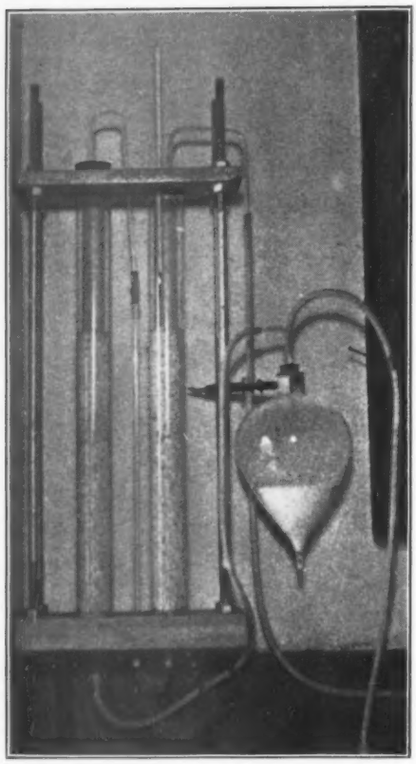

Fig. 2.—The Improved Enslow Stability Indicator in Service.

TABLE NO. 1

MONTHLY AVERAGES

	pH					Alkalinity as $CaCO_3$ ppm.			
1940	Enslow Stabilizer pHs	Langlier pHs	Tap	Reservoir	End Distribution System	Enslow Stabilizer Eff.	Tap	Reservoir	End Distribution System
March	9.0	9.0	9.1	9.0	8.6	20	21	20	21
April	9.1	8.9	9.1	9.1	9.0	23	24	23	24
May	8.7	9.0	8.8	8.9	8.8	25	24	25	25
June	8.4	8.8	8.6	8.6	8.5	23	23	23	24
July	8.4	8.9	8.6	8.5	8.5	25	23	23	22
August	8.3	8.8	8.5	8.4	8.5	27	27	26	28
September	8.5	8.8	8.7	8.5	8.5	24	25	24	25
October	8.7	9.0	9.0	8.7	8.8	24	25	24	24
November	8.8	8.9	9.0	8.9	8.9	25	25	27	25
December	8.9	9.0	9.1	9.1	a.	20	21	22	a.
1941									
January	9.1	9.0	9.1	9.1	8.9	23	23	23	22
February	9.0	9.0	9.1	9.1	9.1	21	22	22	23
March	9.0	9.0	9.1	9.0	9.1	21	21	22	23
April	9.0	9.0	9.1	9.1	9.0	22	21	22	23
May	8.9	8.9	9.1	9.0	9.0	23	25	24	25
June	8.6	8.9	8.8	8.8	8.7	26	27	26	28
July	8.5	8.8	8.6	8.6	8.6	27	28	27	29
August	8.4	8.7	8.5	8.5	8.5	33	33	33	32
Average	8.74	8.91	8.88	8.83	8.76	24.0	24.3	24.2	24.8

a. No samples taken.

contact with fine precipitated chalk; high velocities at the vertex cause a moderate expansion of the entire mass of chalk, allowing the water in its upward travel, under decreasing velocity to "filter-through"; and the effluent from the "contactor" is substantially clarified, leaving only a small amount of fine material to be filtered or plated out by the coarse marble chips later. See Fig. 1.

Results of Operation

Our Continuous Stability Indicator with the above modification has been in operation since February, 1940. During that period daily samples have been taken at two widely separated points on the distribution system, and compared analytically with samples from the Stabilizer and with the finished water pumped from the treatment plant. One point of sampling is our open elevated storage reservoir, where treated water is retained for an average of one week. The other is at an extreme end of the distribution system, where water use is relatively small. Admittedly these two points represent conditions at which sustained stabilization is most difficult.

Table No. 1 shows the results of a year and a half operation and the average monthly figures in both alkalinity and pH of the water at various points. The figures on total alkalinity indicate that the water was in

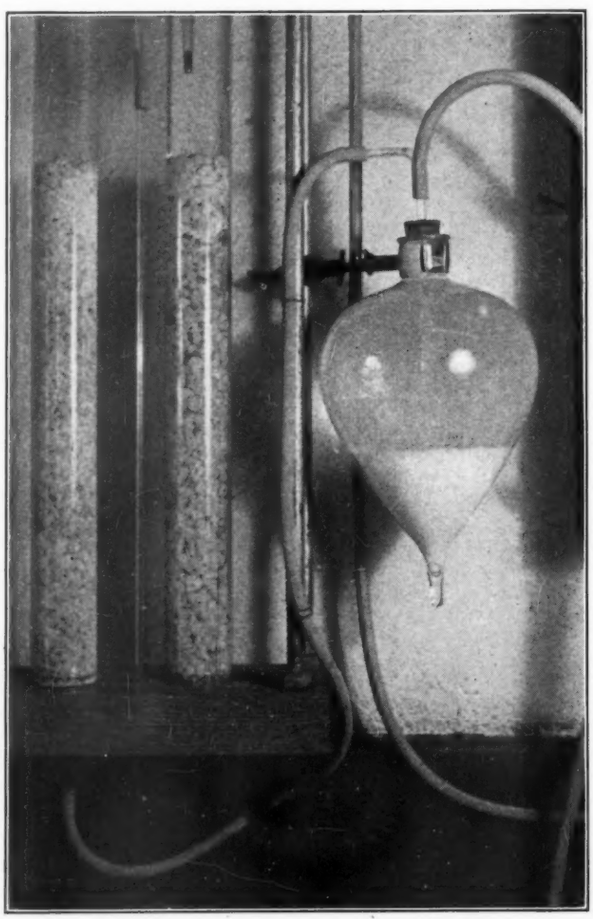

Fig. 3.—The Enslow Stabilizer at Closer Range. Water at rate between 25 and 35 mls./min. is passing through. Note how it clears up in passing through the marble chip trap tubes, the outlet tube being that with the thermometer bulb showing in it.

equilibrium and that it did not tend to dissolve or deposit calcium carbonate. In other words, within the limit of accuracy of tests, the water was well-stabilized when treated according to indications given by the Enslow Stability Indicator.

It will be noted that the pH of the Stabilizer effluent is lower than that of the treated or tap water, although the alkalinity will be the same. This is believed to be due to the fact that small amounts of gases, such as CO_2, are dissolved in Stabilizer effluent while dripping into the container. For this reason, we disregard the pH readings on the Stabilizer effluent and treat, instead, to maintain a final treated water alkalinity equal to that shown by the Stabilizer effluent.

Enslow Index vs. Langlier Index

Since 1937 we have been determining the Saturation Index by the Langlier Formula.[2] For comparative purposes I have included a column labeled "Langlier pHs," which is a monthly average of the Langlier pH of saturation. It indicates that on an average the pH of saturation indicated by the Stabilizer is somewhat lower than that calculated by Langlier formula.

In the early fall of 1940 an interesting change took place which illustrates the practicability of the Continuous Stability Indicator. We had been taking untreated water from one source which was practically identical in characteristics to that of another source. The only apparent difference was one of carbon-dioxide content and a depressed pH. A change was made from one source to the other. No alteration in coagulant dosages was required, yet the following changes occurred in the Stabilizer Effluent overnight.

	Raw Water No. 1	Raw Water No. 2
Date	9-23-40	9-24-40
Turbidity, ppm.	70	65
Alkalinity, ppm.	15	14
Free CO_2, ppm.	13	6
pH	6.2	6.7
Stabilizer Eff. pH	8.2	8.8
Stabilizer Eff. Alkalinity, ppm.	29	21

It must be admitted that considerable changes of this magnitude could not have been foreseen or predicted by any other simple method.

Some Notes on Operation

The total water capacity of the Stabilizer used at Durham is 3230 mls. exclusive of the volume occupied by the chalk and marble chips. The capacity of each part individually is as follows:

	Mls.
"Contactor"	2050
Twin tubes filled with marble chips (590 mls. ea.)	1180
Total capacity	3230

Each of the twin tubes contains about two and one-half pounds of marble chips. The "Contactor" contains approximately 200 gms. precipitated calcium carbonate. The latter is introduced into the "Contactor" mixed with 500 mls. water. The cone is filled completely with additional water and the mass allowed to settle thoroughly before placing into operation.

The normal operating rate is 25-35 mls. per minute, resulting in a contact period of approximately two hours. The "Contactor" alone provides nearly two-thirds of the total time. It is very important that the rate shall not ever materially exceed the upper limit, otherwise the purpose of the "Contactor" will be defeated by carrying over fine calcium carbonate into the effluent. A slower rate is satisfactory and for some waters the longer contact period may prove an advantage.

It is advisable to mount the Stabilizer in a place out of direct sunlight to avoid the possibility of microscopic growths.

Occasionally it will be found desirable to clean the entire system and introduce new calcium carbonate into the "Contactor." A dilute solution of Hydrochloric Acid followed immediately by a thorough rinsing with water seems to accomplish the desired result quickly and efficiently.

After placing the Indicator in operation it will be found that some of the extremely fine (almost colloidal) chalk will be swept over for the first day or two. After this the effluent clears entirely, the colloidized chalk, if any, plating out on the marble chips.

References

1. "The Continuous Stability Indicator," Linn H. Enslow. *Water Works and Sewerage*. 86:107 (1939).
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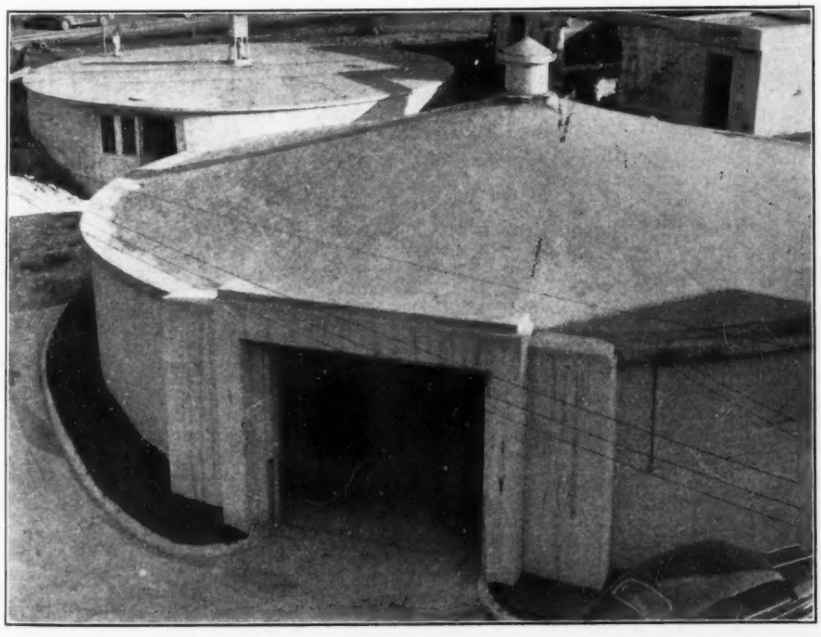


Old Water Plant Becomes Air Raid Shelter

The accompanying picture shows the abandoned filtration plant and clear water reservoir of Asheboro, N.C., which this city has converted into an air raid shelter. The old plant, with its 60 ft. diameter reinforced concrete reservoirs 20 ft. deep, happened to be conveniently located at the rear of the City Hall.

MAINE WATER UTILITIES ASSOCIATION

Concentrates on Defense at 13th Annual Meeting Held in Portland

WHEN the dinner gong sounded at noon, Feb. 11th, at the annual Portland meeting of the very much alert Water Utilities Association of Maine, the number of "paid admissions" counted were 161, representing 49 water suppliers in the state of Maine.

As in the case of the twelve meetings before the Portland Water District was host to the Association. On the evening of Feb. 10th all were guests of the District at one of those annual P.W.D. suppers for which wives of the District's employers have become famed. To this reporter's thinking the superb P.W.D. clam chowder (Maine style, of course)—and those Portland doughnuts should be sufficient alone to draw in the gang for supper and the evening session that follows.

Following the supper and prior to the Technical Session, the District also put on a good hour of entertainment, consisting of some professional Portland talent plus that by

Ralph E. Manson, Manager, Colais Water and Power Co. (Presided for President Moulton)

Francis H. Kingsbury, Engineer, Mass. Dept. of Public Health (President of NEWWA and honored guest)

Erwin E. Toothaker, Supt., Water District of Strong, Me. (Newest member at the meeting)

employees of the District. With a splendid supper tucked away and a good "seegar" to puff on, all were comfortably ready for the interesting technical session that followed under chairmanship of Fred J. Reny, General Manager of the Portland Water District.

P. W. D.'s Evening Session

(Fred J. Reny, Presiding)

Mr. Reny opened the session with an interesting story of the "History of Portland's Water Supply in Its Early Days."

Mr. Reny's paper resulted from material which he had been digging out here and there in his interest as

Annual Host
Fred J. Reny, General Manager, Portland Water Distr. (A repeat performance every year.)

"President Dave"
David E. Moulton, Attorney, Portland Water Distr. (They were glad to see him back again.)

something of a researcher and a desire to have in the archives of P.W.D. an authentic history of "Portland's Water Supply from the Founding of the Community."

Beginning with the individual wells and cisterns of the more wealthy residents and the public springs and wells from which water was toted to the homes, Mr. Reny described the early brick cellar cisterns of 12 to 15 foot diameter with a wall of "filtering and purifying brick" constructed across their diameter and through which the water used had to seep. The earliest semblance of a public supply was one of the better known springs of sufficient flow to provide a full flowing 2 inch pipe line into the community.

Of considerable interest to his audience were the early side-walk fire reservoirs constructed by the early city at numerous points throughout the business district and the important residential section of Portland. These served the old hand pumpers of early times and the well known bucket brigades of wholly volunteer fire fighting organizations wherein there was considerable competition and rivalry.

The balance of Mr. Reny's report had to do with some of the several famed springs of Portland, several of which boasted remarkable sustained flows the year round. When Mr. Reny's "History of Portland's Water Supplies" is completed it will constitute an appreciated addition to the library of the P.W.D. and the city's archives.

"The Drought and Its Effect on the Supply of the Portland Water District" — by Harry U. Fuller, Chief Engineer, Portland Water District, Portland, Me.

Hardly anyone ever expected to see Portland concerned over the possibility of a water shortage from the great Lake Sebago supply of the

J. Arthur Jackson, Asst. Treas., Portland Water District (Reviewed P.W.D.'s Defense Progress)

Leo K. Andrews, Auditor, Augusta Water District (Secretary of the Association's Defense Committee)

Harry U. Fuller, Chief Engineer Portland Water District (Revealed drought effects, bringing Lake Sebago supply to lowest level in 37 years)

Portland Water District. But, such has come to be the case and P.W.D. officials give signs of being jittery as the result of the protracted dry

Defense Demonstrations

(1) A magnesium bomb is set off. (2) Use of the Mist Spray for control of burning. Also sand smothering was demonstrated as the best overall scheme. (3) P.W.D.'s chemist—Harold Scales—demonstrating a W&T Portable Chlorinator and Proportioneer's Chlor-O-Feeder in main sterilization procedure. (4) and (5) Impressive demonstration of the Mist Water-Spray Nozzle in rapidly extinguishing oil fires—by Eastern Fire Equipment Co. of Portland

period which has caused the elevation of the great Lake Sebago to constantly diminish without the usually anticipated spring filling in sight because of the paucity of snowfall of the past winter.

Mr. Fuller, with the use of slides, reviewed the elevation trend of Lake Sebago which has for the past 18 months or so continued to go down, to reach the lowest point in 37 years —i.e., since 1905. All of this has been due to a cumulative precipitation deficiency of 20 inches during the past year and the dark side of the picture is the thinness of snow blanket on the shed, which is ordinarily counted on to fill the lake. And unless 13 inches of precipitation is realized in the months of February and March Portland faces a lack of supply.

Major J. H. Brewster, Sanitary Engr., Field Coordinator 1st & 2nd Corps Area U. S. Public Health Service

Everett O. Boothby, Ass't Supt. Portland Water District (Handles many details of Portland meetings)

Earl A. Tarr, Supt. Winthrop Water District (Secretary of the Association since its organization)

The Portland picture would really be alarming but for the fact that Lake Sebago, which holds a 30-year supply for the Portland District, is a long way from going dry. What it does mean is that Portland's gravity supply intakes may become insufficiently submerged to deliver the 15 m.g.d. required. In such event the deficiency can be made up by installation of emergency pumps. That this possibility may become a necessity has been taken into account by the District and since Mr. Fuller's report two portable gasoline engine driven pumping units have been put under order as recounted in the article on defense preparation by Mr. Jackson of P.W.D. which follows in this same issue.

Some idea of the size of Lake Sebago and its catchment area can be had from the statement by Mr. Fuller that 1/16th inch of precipitation per month would prove ample for P.W.D.'s requirement of 15 m.g.d.; that the lake holds a 30 year supply without a drop of replenishment. To some of us it was a surprise to learn that in Maine climate evaporation

S. S. Anthony, Supt. Augusta Water Dist. (Editor of M. W. U. A.)

Horace J. Cook, Supt. Auburn Water Dist. (Defense Committee Chrm.)

from Lake Sebago averages 3 ft. per year. The real cause of concern is not the present elevation of the lake, which would be safe, but for the allocation of riparian water which must be let down the river from the lake for important industries.

"The Defense Program of the Portland Water District"—by J. Arthur Jackson, Ass't Treasurer, Portland Water District, Portland, Maine.

Mr. Jackson's interesting revelations of the alertness of the P.W.D. in progress made and plans to be consummated in its defense program is to be found in his paper which is printed elsewhere in this same issue.

What has already been accomplished is a splendid commentary on the management and operation of the Portland Water District system and reflects something of what has been accomplished by Maine Water Utilities on the whole. We know of no section of the country where preparations for eventualities have been more effectively prosecuted.

Following Mr. Jackson's paper Fred J. Reny, Gen'l Manager of The District, revealed his several unsuccessful efforts to procure a military guard from the 1st Corps Area Command for the most vulnerable points on the P.W.D. system. Guards had therefore been provided by the District, consisting of specially qualified men sworn in as Deputy Sheriffs. This is costing the District roughly $35,000 per year plus the cost of equipage, telephone lines, fencing and incidentals. [We have heard since the Portland meeting, however, that Mr. Reny has again reopened the matter of procuring military guards since the supply is so vital to military and naval establishments in the Portland area.]

Exhibits and Demonstrations

The forenoon of the second day was given over to inspection of manufacturers' exhibits and demonstrations of fire-fighting, the handling of incendiaries and emergency main chlorination.

War conditions made themselves felt to some extent in the manufacturers' exhibits arranged in the spacious Service Building and Shops of the P.W.D.—where, incidentally, all meals were served, and technical sessions were held. Those exhibits which received the greatest attention were, naturally, those displaying equipment and materials of a defense nature.

Following the period devoted to exhibit inspection and shop-talk, the demonstrations pictured with this report were put on. The first was a demonstration of how to cope with magnesium and thermit incendiary bombs which was put on by N. L. Mathews, Technical Sgt., 2nd Bat-

Norman L. Mathews, Technical Sgt., Maine State Guard, Waterville, Me. (Demonstrated fighting fire and incendiary bombs)

Howard H. Potter, Engineer Maine Utilities Commission, Augusta, Me. (State Water Supply Co-ordinator for Maine)

J. B. Swain, Supt., Caribou Water Co., Caribou, Me. (Split with Ralph Manson the prize to that member traveling greatest distance for the meeting)

talion of the Maine State Guard. Mr. Mathews showed what not to do as much as what to do to smother a burning magnesium bomb. Later moving pictures were shown of similar procedures and it was evident that a fine water spray was effective in cooling a burning bomb to control its burning whereas water would not put out the magnesium fire and, in fact, caused it to burn the more vigorously and explosively if a stream of water was applied. While water is necessary for control of fire already started it is seemingly not the best material for smothering or cooling the burning bomb. The demonstration, involving the spreading of dry sand over the burning bomb, revealed the greater efficacy and safety of the sand smothering method which permits scooping up the entire mass with a shovel, after cooling it with the sand blanket and depositing it in the bucket containing 6 inches or more of sand where it may then burn itself out without

(1) *"Bob" (R. C.) Fergusson Hersey Meter Co., Boston and H. W. Dotten, Supt., Water and Sewerage Winchester, Mass.*

(2) *"Reggie" Hayes (Hydraulic Devel. Corpn.) and Judge George Boulter (Kittery) "in conference"*

(3) *In P. W. D.'s Meter Shop— "Bob" Fergusson (Hersey Mfg. Co.), Clifford Fogg, Shop Foreman, and Chesley W. Ward, Supt. of Meters*

(4) *Sgt. Mathews starting a magnesium fire in the demonstration*

(5) *Al. W. Read, Superintendent Bangor Water District and C. E. Gilbert, Member of the Water Board*

damage. Or, better yet, to take the bucket and burning bomb out of doors.

Then followed an effective demonstration of the mist-producing fire nozzle for extinguishing fires with the minimum quantity of water. The accompanying pictures show a representative of the Eastern Fire Equipment Co. of Portland quenching a roaring crude oil fire with this mist nozzle operating at about 50 lbs. pressure. The quickness of the job indicated the fire smothering value of steam produced from the mist instantaneously. The whole job took roughly 5 gals. of water none of which escaped apparentiy to do water damage which a stream would have created. However, the real impressiveness was the speed of smothering such a hot fire.

The third demonstration was that made by Harold B. Scales, P.W.D.'s Chemist, employing a W. & T. emergency Chlorinator and Proportioneers "Chlor-o-feeder" on a main sterilization job. An accompanying picture taken inside of the building where light conditions were poor shows Mr. Scales adjusting the portable emergency W. & T. chlorinator while the little gasoline driven "Chlor-o-feeder" was busily "put-putting" in hypochlorite solution.

Dinner Session

(And the Return of Prexy Dave)

At head table for the Dinner Session members were happy to welcome back Dave Moulton, P.W.D. Attorney, continuous president of the Association since its founding. Mr. Moulton, after 5 major operations and 9 months out, was as happy to be back again, and to receive congratulations rather than carnations, as any of the many members who pulled for his recovery. Smiling again and chipper, we got the accompanying snap-shot to prove as much.

For President Moulton, however, Ralph Manson, Manager, Calais Water Co., officiated at the Dinner and Afternoon Sessions.

Report of Taxation Committee

Following the dinner two committee reports were presented. Jo. W. Randlett, Sup't at Richmond, Me., reported as chairman of Committee on Taxation concerning the Association's fight against taxing of municipal bonds by the Federal Government. He stated that Congressman Brewster of Maine advises that the matter is a dead letter in Washington for the present at least but may be reopened later. The Maine Association has gone to expense and some effort in its support of organized action against passage of the act which would remove tax exemptions from all municipal bonds.

The Defense Committee Reports

As chairman of the Association Defense Committee, which has accomplished so much in a short time and received such splendid cooperation from managements of Maine's Water Utilities, Horace J. Cook, Auburn's Superintendent, rendered a report from which the following has been taken.

Report of the Defense Committee

Rumors have been prevalent that certain chemicals for some types of chlorinators would not be available for water utilities. The Defense Committee investigated the matter and found that these chemicals could be procured. In fact we learned that at least five plants where these vital chemicals are manufactured are located in the State of Maine. The committee recommends, however, that depots of these chemicals be installed in various sections of the State for additional security.

Mr. Howard Potter, Engineer for the Public Utilities Commission, is the new Water Works Co-ordinator for the state. The manner in which your committee is cooperating must be very gratifying to Mr. Potter. All of our information gathered through the questionnaires and months of work has been given him. We urge every member and every utility to help the Water Works Co-ordinator to the best of their ability.

Mr. Potter believed it advisable to make some slight changes in our zoning plan. This appears to be a wise move. Zone co-ordinators and alternates will be appointed soon. If asked to serve, unless you are willing to give freely of your time and effort do not take this added responsibility. He must have some one upon whom he can depend.

On February 3, the committee met at the office of the Public Utilities Commission with Colonel Farnum and Chairman Southard to find out exactly how we fitted into the whole plan of civilian defense. After being given a summary of the present organization of the Maine Water Utilities for mutual defense, both Colonel Farnum and Judge Southard complimented the water works men, stating that they were way ahead of any other group in the state.

Colonel Farnum then described the Civilian Defense Organization. It is headed by the Governor and an Executive Committee.

In a city, the Mayor is the commanding officer. His assistant is called Chief Air Raid Warden or, according to the War Department, he is the Controller who operates the Report Center. The locality is divided into blocks or zones containing about 500 people. They are patrolled by an Assistant Air Raid Warden who must relay to the Report Center information of all damage and casualties.

At Report Centers will be representatives of the various groups: fire, police, disaster, Red Cross, utilities, etc., at phones to transmit orders of the Controller as information reaches him. The utility representative will report to water supply headquarters where breaks have occurred. It is our responsibility to repair these and keep the water service operating.

The Air Raid Warning System is based on an observation line of Navy ships out at sea, and inside of which is the Coast Guard Patrol. Along the coast is still another line. On land are observation posts, one to every twenty-five square miles, manned by volunteers and operated on a twenty-four hour basis. The information from all these agencies goes through various filter centers to the Head Command of this area. Sixteen Warning Centers have been located in Maine, with trunk line telephone service to the Report Centers in each city or town. The air raid warning comes from headquarters through these Warning Centers to the local Report Center from which the local notice of air raid is given.

The committee has several suggestions to make to the members:

(1)—It is a good plan to organize the plumbers of your community as an auxiliary repair crew. Hold a few classes and show them how to run joints with compound.

(2)—Teach as many as is practical of your own crew to make and run joints.

(3)—Have plans of your system and gate locations deposited with trusted employees in various sections of your locality.

(4)—In case of air raid warning, don't have all your trucks and equipment in one place.

(5)—A good idea is to have pipe and specials stored in several sections of your city.

A Tire-Rationing Resolution

Following presentation of his report as Chairman of the Defense Committee, Mr. Cook presented the following resolution which was unanimously approved for transmittal to the proper authorities:

Whereas the supplying of water for domestic, sanitary and fire protective purposes is the most essential of all public services in a community, and is absolutely necessary at military and naval establishments, and vital defense areas, and

Whereas the failure of this service in any of these areas means total cessation of all activities and eventual evacuation, and

Whereas the immediate presence of the superintendent or other operating official at scenes of disaster to the water supply system is essential for quick repair and for the continued normal operation of the utility, and

Whereas under the rulings of the Tire Rationing Board, tires and tubes are not available for purchase for the automobiles used by such superintendents, therefore be it

Resolved that the Maine Water Utilities Association respectfully petition the Tire Rationing Board that the said rulings be amended so as to permit the purchase of tires and tubes for automobiles of such operating officials to be used, only in the performance of their duties.

Appparently there is no difficulty in procuring tires for Water Department of Water Company trucks, whereas tires for officials' cars are denied. This may suggest that superintendents purchase one of those fancy station wagons and register it as a speed service or maintenance truck. Fact is these are pretty handy vehicles to have in service in any event, whether it be hauling plutocrats or pick-axes.

(1) *Harry R. Prestcott, President H. R. Prestcott and Sons Worcester, Mass.*

(2) *Jas. M. Caird, Consulting Chemist Troy, N. Y. (Recently made Honorary Member A.W.W.A.)*

(3) *J. S. Lufkin, Red Hed Mfg. Co. (For 56 years he sold National Meters; is 74 years young)*

(4) *A. F. McAlary, Supt. Camden-Rockland Water Co. Rockland, Me.*

(5) *"Reggie" Hayes, Hydraulic Devel. Corpn., Boston*

"Water Supply Protection and Defense"—by Major John H. Brewster (USPHS), Sanitary Engr. in Charge, 1st and 2nd Civilian Defense Regions, New York City.

In Major Brewster's talk he emphasized the dangers from a let-down which is logically to follow this period of alertness and expectancy of difficulties. It will be later in this expected period of let-down, since nothing has happened, that the enemy will begin its serious sabotage efforts, including attempts possibly to poison water supplies and perhaps injection of bacterial cultures into water mains.

Fortunately chlorine is assured to always be available to water utilities, and used in proper quantities will take care of such situations. Major Brewster advised every water works manager to either begin chlorination or prepare for it.

As to providing guards for water works properties, the U. S. Army will survey situations and make recommendations of the proper guard pattern, but expects every utility requiring guards to supply such and not look to the Army.

In the matter of repair squads, the Major stressed the need for preparatory organization and planning ahead for auxiliary repair squads. Since so many important defense industries have come to be dependent upon water supply from the public systems of America, the Water Utility holds a highly important position in the defense of this Nation. This much should impress managers with the high need for adequate preparations to restore any disrupted service by repairs, the provision of duplicate equipment, vulnerable supply lines, etc.

If water works management does not take the lead State Defense Comcils will be asked to see that repair squads are set up and trained. In this labor should be pledged to serve in emergencies with the first thought of restoration of water and sewer facilities. This brought to mind that such repair squads should be capable of and equipped for repairing sewers as well as water mains that go out together in air raids.

"The Water Supply Co-ordinator"—by Howard H. Potter, Engr., Maine Public Utilities Comm., Augusta, Me.

Mr. Potter, recently appointed State Health Supply Co-ordinator, outlined the duties of his new posi-

(1) *"Matt" Allen Builders-Providence, Inc. Providence, R. I.*

(2) *Jo. W. Randlett, Supt. Richmond Water Works*

(3) *Judge Geo. D. Boulter Kittery Water District (The Judge loves a convention)*

(4) *Francis L. Hatch, Supt. Kittery Water District*

(5) *"Ted" W. Grindle, Manager Bar Harbor Water Co.*

tion, the success of which depended on co-operation from Maine Water Utility Managers, as both the base and arch stones. It was his duty to serve as liaison officer between Federal and State authorities and Water Supply heads.

Maine was to be divided into 10 zones with a zone co-ordinator to be chosen to serve in each, said Mr. Potter.

In commenting on cooperation the new co-ordinator recommended that the water utility head in every community should contact the chief civilian defense officer in his community to avoid possible conflicts and confusion at some disastrous time possibly. Particularly important was this in respect to arranging for auxiliary repair squads for water supply service and insuring that available labor is not all pledged to other less important services than water supply.

Another suggestion, or request, made by Mr. Potter was that water supply heads needing help in planning or controversy with local defense officials should go direct to the zone or State co-ordinator *first* and no one else. The co-ordinator would continue to work in close cooperation with and look to the Defense Committtee of the Association for suggestions and requests for any service that he might give. He was highly impressed with the excellent —and highly useful—inventory of materials in the State, gathered together by the Association and now turned over to his office. He felt certain that Maine had done this job ahead of any other state.

In reply to questions Mr. Potter said that extensions of mains should not be made unless materials had been specifically obtained for the purpose. There could be no possible argument for dipping into inventory materials for making such extensions and getting replacements might prove considerably difficult. In short, the policy of each tub on its own bottom should be practiced in respect to main extensions. In no wise should inventories be depleted without replacements being ordered immediately.

Mr. Cook, in commenting, stated that the committee, after reviewing inventories filed with it, had asked several managers to strengthen their inventories in regard to certain materials and equipment. Now that had been done and practically all Maine Water Utilities can point to a plus inventory which should be maintained with little or no depletion for the duration at least.

The last speaker on the program was Portland's Chief Air Raid Warden—Lieut. Col. G. C. Kern (U.S.A. Retired), who outlined the duties of air raid wardens and control centers. Portland, he said, will have a fictitious air attack within the week just to test the organization for performance and weak spots.

The Bombing of London

At the close of the meeting a moving picture revealing happenings during the several bombings of London and the aftermath impressed all present with the effectiveness of direct bomb hits on water mains and the high cost of water supply failure during fires created by the raids. This picture also revealed the methods of reporting main breaks and the functioning of water supply repair squads during air attacks.

First and last the picture gave us much to think about and further raised our admiration for "our cousins across the pond" who have so thoroughly proved that they could take it standing up or any other way.

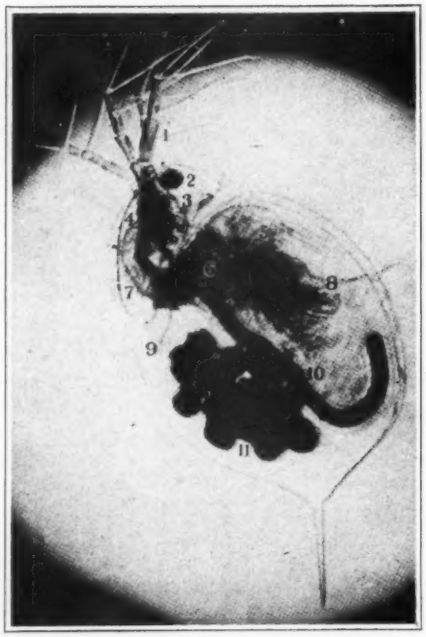
Daphnia Magna

A Remarkable Living "Reagent"

Few water works men have ever suspected the troublesome Daphnia of possessing such remarkable attributes as have been recently credited to it. As a "living reagent", Dr. Arno Viehoever, Director of Biological Research Laboratories, Philadelphia College of Pharmacy and Science, has for some years found the little transparent crustacean, Daphnia *Magna,* of high value as a test animal.

Of Dr. Viehoever's work, we have clipped the following comments from *"The Merck Reporter."*

"This remarkable 'reagent' permits the visual study *in vivo* of qualitative and quantitative reactions from therapeutic, toxic, clinical, and fatal doses of medicinal products, the physiological mechanism of their action, and also the evaluation of temperature, oxygen pressure, light, and other biophysical influences. In addition, the effect of biochemical factors as food elements, minerals, vitamins, hormones, enzymes, may be observed. Optical magnification facilitates a close and comprehensive view of the mechanism of the Daphnia's organs. (See cut.)



Daphnia Magna: *1—Swimming Arms. 2—Eye with Lenses. 3—Muscles with Optical Nerves. 4—Liver Glands. 5—Nephridial Bands. 6—Shell Gland. 7—Stomach (without Food). 8—Breathing Organs. 9—Heart with Valve. 10—Intestine with Food. 11—Brood Sac with Eggs.*

"Among the effects observed may be mentioned those from adsorbents and disinfectants. Remarkable are the visualization of the actions of physiological antagonists and antidotes to poisons, the typical manifestations in some instances as they occur in higher animals, and the promising field for experimentation which this unique method of study presents."

Dr. Viehoever states that the breeding of Daphnia for experimentation is readily and economically accomplished. (Did we hear some water works man say — "and too readily accomplished!")

A WATER SUPPLY DEFENSE PROGRAM*

As Adopted and Prosecuted by the Portland Water District†

By J. ARTHUR JACKSON
Assistant Treasurer
PORTLAND WATER DISTRICT
PORTLAND, MAINE

FOR the past twenty years we have experienced an era of supreme confidence, luxury and unopposed span of easy living. This we now know was justly called "Peace," but to us here assembled tonight comes stern realization, that this era should be called the "degradational era," from which we now must awaken and arise, without any equivocation, to a long and desperately opposed uphill fight to victory.

We have encountered an entirely different phase of life—a swirling, amalgamated turmoil of colossal energy, of human and mechanical processes, earmarked as war, whose sinews reach out to enmesh every phase of human existence within our national borders, regardless of creed. Therefore, permit me to dissect the word "war" symbolized by—

W—for Wager
A—for And
R—for Resistance

or commonly termed offense and defense.

Naturally, water supply comes only under the heading of defense, and water authorities are called upon to adopt definite defense schedules that will not be found wanting when the test comes.

The Program and Accomplishments of the Portland Water District

At this time I should like to review the preliminary work of the Portland Water District, performed before the war started. For by analyzing this work, one can now detect the co-ordination and value of this work in peace time and that which is needed in war time. During the transient period when war clouds were gathering over this country, our hydrants were tested; gates checked and operated; standpipes fenced; the shop fenced and floodlighted; supply intake property fenced; stock and material augmented; office supplies checked and increased; shop supplies augmented;

The Author

shop equipment increased; pipe and fittings inventoried and augmented; auto parts, tires, oil, grease, rubber boots, rubber gloves and small tools increased; gate books checked; weak spots in distribution located and corrected; weak spots in transmission lines surveyed; co-ordination with the Civil Authorities; school for instruction for employees by Maine utilities; new submarine pipes laid on account of the growth in the military personnel and construction; transmission chambers protected by steel houses; inventory of all stock and material and duplicate copies distributed, as well as the material itself shifted to strategical locations. This appears to have been only the beginning, but we felt that we had accomplished considerable in the right direction when the news of Pearl Harbor came. It was then that we appreciated that our preparedness efforts had not been time and expenditures wasted.

Springing into action immediately after Pearl Harbor, the District's first move was to further cooperate with the Maine Water Utilities Association in cementing all Maine Water Utilities into unity in this time of emergency, concerning material and supplies, interconnecting of supply to nearest neighbor, furthering a closer relationship among all water utilities, taking inventory of stock and location dumps, copies distributed freely for emergency use, checking up on all special apparatus, floodlights, shop needs, emergency purification equipment, augmented stock of chemical, fire equipment such as trailer pump, Indian hand sprayers, emergency truck, boxes of spare fuses of all sizes, alternate and direct, 120 volts and up, various amperage and style for machinery, lights, tools and pumps.

Our Engineering Department went into high gear on outside checkups on weak points, protection of reservoirs and transmission mains, source of supply, correcting all data, checking gate books, making new maps and checking the old maps for duplications for the District and also the Civilian Defense and Fire De-

†The Portland Water District is comprised of the City of Portland, Me., and 17 outlying communities or sub-districts.

PHOTO	PORTLAND WATER DISTRICT IDENTIFICATION CARD NAME ..... RESIDENCE ..... NATIONALITY ..... OCCUPATION ..... EMPLOYER ..... DATE ..... NO. ..... SIGNED ..... TREAS. AND GEN. MGR. .....

Identification Card Required to Be Carried by Every Officer and Employer of the Portland Water District

*A paper read before the Maine Water Utilities Assn. in Portland, Me., Feb. 10th, 1942, and here reproduced by permission of the Association.

partments of various towns and cities supplied by the District.

Our Purification Department checked emergency chlorine equipment, figured formula for dosages, tested out machinery on actual working basis, checked chlorine and other chemicals on hand, checked past tests of emergency sources of supply and accumulated all past data.

The management ordered all personnel to be fingerprinted and photographed; to carry passbook identification and wear numbered buttons, duplicates of which were put on file in the office and the originals sent to the F. B. I. in Washington. (A specimen of this identification card and badge is here shown.) *Not a single officer or employee of the District was exempt.*

Numbered Identification Button

At the same time, the entrances to the shop and rear entrances of the general office were locked and signs posted, notifying that no visitors would be admitted except by pass from the general office. These passes are numbered and duplicated, the original is secured at the office, taken to the building for admission, and at the close of the visit is returned to the office by the District official who admitted the visitor.

Cooperation with Civil Defense Authorities

When the matter of civilian defense came up, the Water District registered 21 deputy sheriffs, which through the courtesy of Sheriff Burnell were made available to the District as law enforcement officers, thereby co-ordinating efforts of the District with those of County officials. Two Water District representatives were delegated to attend the public meeting of the Civilian Defense Committee in City Hall. This resulted in three P. W. D. employees being assigned to the air raid warning center. The special Deputy Sheriffs attended the Sheriffs' School of Instruction, which is still functioning. Others took first aid instruction, airplane spotting, etc. Of course, no water works employee could take on a regular assignment because of the fact that first and foremost his duty is to the Water District. It was felt, however, that the District's personnel should sign up for and take courses which would help him or her to be of greater service to the District, and might actually be available for other work in spare time. In other words, the personnel's duty is the Portland Water District *first*; cooperation and assistance, second. This principle has proved to be correct, for it was fortunate for us that we had guards for the district.

When war broke out, our general manager, Fred J. Reny, had on file two written requests, both of which had been refused, and a conference had been held with military authorities in regard to the protection of P. W. D.'s vital water works facilities of the First Corps Area. The results were negative, because of military shortage, and therefore no military guards were available to the District. Also at this same time our Trustees cooperated and decided to allow P. W. D. employees to pledge for the purchase of defense bonds by salary deduction weekly. To the honor of the District goes the distinction of applying the State of Maine motto, "Dirigo" (I lead), for we were the first in Portland to start this noble action. I desire, at this time, to call your attention to this phase of war work which should not be neglected. Buying these war bonds not only helps win victory, but it also produces a savings account which will stand investors in good stead after the war is won.

Some Specific Attainments

In the foregoing description I have generalized. Let us now take a short trip over the P. W. D. system. We will start at the Munjoy reservoir and pump house. There are three watchmen stationed there to patrol the reservoir grounds once an hour. They carry recording punch-clocks and are in touch with the general office by telephoned reports every hour. Each watchman has an eight hour shift to give 24 hour protection.

The Main Offices

We will now go to Casco Street, where the main office is located. There are seven fire stations—one in the basement, one on the main floor, two on the second and third floors, and one in the stairway to the roof. Each station is equipped with a fire extinguisher, a pail of sand and shovel, a sandbag, a flashlight, kerosene lantern, matches, and a medium sized first aid kit. At the main floor station is a large size first aid kit, book of instructions, and the locations of other stations and equipment.

Each male clerk has been assigned his position. For instance, at the sound of an alarm, two men go to the roof, one with sand and the other with extinguisher or hose, which is ready for use. The others go to their allotted stations on the second floor, on the first floor and in the basement, securing their tools and later reinforcing the man whose station has been attacked. In other words, there will be no confusion and each one will have a useful part in the final picture. The ladies are advised to remain calm and composed and to

ORIGINAL

PORTLAND WATER DISTRICT
VISITOR'S PASS

NO. 35

PORTLAND, ME. 194

Mr. .....

of .....

is given permission to visit the .....

Building of the Portland Water District.

Signed .....
TITLE

THIS PASS IS TO BE COLLECTED AT THE BUILDING AND RETURNED TO 16 CASCO ST.

Visitor's Pass Issued Only at the Main Office of the District

assemble either in the corridor or central part of the building or in this exceptionally well posted and heavy framed building to seek safety in the cellar. The cellar piers are of brick construction about 4 feet square and 8 feet in centers, so they are capable of sustaining the load of the debris overhead, and there is also a sidewalk opening for emergency exit, as well as a back stairway and elevator well.

Shop, Reservoirs and Transmission Mains

Now, let us go to the main shop. The floodlight covers the entire fenced yard. The fire protection, consisting of sand boxes and extinguishers, trailer pump and Indian hand pumps, emergency truck and crews, emergency fire truck, watchmen and garage men, constitute a formidable defense organization.

From here we go over the pipe lines to Sebago Lake, noting first the different reservoirs:

Bramhall Reservoir, fenced and locked.

So. Portland Standpipe, fenced and locked.

Oak Hill Standpipe, fenced and locked.

Dunstan Standpipe, fenced and locked.

Falmouth Standpipe, fenced and locked.

Prouts Neck Standpipe, fenced and locked, with spotters' station outlook built by P. W. D. as a courtesy for airplane spotting.

Newhall Standpipe, fenced and locked.

Brook Standpipe, fenced and locked.

Peaks Island standpipe fenced and locked.

Along the lines we find the gate chambers protected by steel houses over the concrete chambers, furnishing protection and also storeroom if needed.

Supply Intakes

The two intakes in Sebago Lake are fenced and guarded by three shifts of three men each, with two new men extra for night patrol. In other words, at night there is a double guard. These men are special Deputy Sheriffs, equipped with shotguns, lights, and a firm knowledge of their duties instilled by the chief guard, Mr. Craig, who has no special hours of work but checks any or all of the 24 hours of guard duty in all kinds of weather. These men all have telephone connections, and there are three posts with three radiating positions, equipped with keys. Each man is required to visit these places, take the key and make an impression on a paper disk concealed in a clock which is enclosed in a leather case and carried at the time. These disks are changed every day.

Some Suggestions Based on Experience

You have been inspecting the water works defense. Perfect? Oh, no, but a good beginning. Lacking in some things? Yes.

For instance, here are some suggestions:

1. Some method of co-ordination —publicity or anything that will arouse human beings to the importance of water, and put it in its proper sphere. San Juan case of sabotage is a good example. Hong-Kong blindness produced defeat. Singapore's destiny is now depending on the dependability of its water supply.* Libya suffered her experiences and now appreciates water. The Nipponese army is alert. They know the three-day limit of lack of water, for they have included in their scouts' kits a vial of chlorine for purifying water.

[*Since this was written we have seen that capture of Singapore's water supply reservoirs by the Japs spelled certain defeat and precipitated the fall of this strategic stronghold.]

2. Employees instructed in first aid, say, a 30 hour course. This is a fine place for the ladies to come in.

3. First aid kits at the shop, on trucks, also some of the shop men to take the first aid course.

4. Co-ordinator to check up the above plan, to keep it clicking, and also arrange for school of instruction, drills, rehearsals, organizing of a fire squad with the emergency truck, etc.

5. Equipment, steel helmets for protection, gas masks and protective clothing as a safeguard against such gases as mustard, Lewisite, phosgene, tear gas, etc. Asbestos suits to work near fire on street jobs. Asbestos caps to cap bombs that might fall near street jobs. (Not necessarily a large number but enough for a crew or two.) Rubber gloves and rubber shoes, and rubber coats

★ ★

WATER SUPPLY DEFENSE RULES — READ CAREFULLY

Be sure all of your family understand. Although we do not know whether Portland will be attacked from the air, yet every precaution must be taken.

1. Don't get panicky. There is plenty of water available and in storage in spite of the drought.
2. Be sure you know where your cellar shut-off is, and how to operate it.
3. If the water has been shut off <u>due to air raid</u>, boil for ten minutes all drinking, cooking, and wash water until notified by the proper authorities that the water is again safe. It is a good plan to keep some drinking water in the refrigerator in case of emergency. The English practice is to keep the bath tub filled with water, and to sterilize water for all domestic use by adding one teaspoonful of Bleach Water to each gallon of water.
4. <u>Don't waste water.</u> It may become necessary to pump water here in emergency, and every kilowatt of electricity is needed for defense purposes.
5. See that there are no leaky fixtures in your house. Even a few additional hours of water service might prevent disaster.
6. Don't try to put out an incendiary bomb with a stream of water. Use a fine spray. Dry sand is better still and should be kept on hand.
7. Chlorine dosage will be increased if it is necessary.
8. Keep this card in a prominent place in your kitchen. These rules are sponsored by the Defense Committee of the **Maine Water Utilities Association.**
   For all information regarding water supply call **Portland Water District, 2-6557.**

★ ★

Water Supply Defense Rules

A Card Supplied by the District to Customers for Tacking Up in the Kitchens of All Homes.

(If any changes were to be made we would add a caution to boil all drinking water following an air raid, until notified to the con-

for protection from electric wires near the job.

6. Priority for employees for tires and other necessary articles of maintenance for their autos so they can get to the shop and stations in need. There are few buses and less electric cars at present and these do not run after midnight.

These suggestions are made with full realization of the conditions and a greater understanding of the continually changing conditions of this present-day war, where one cannot lay down a definite law or procedure that will fit all cases. Each water works problem of defense must be made and adapted to each individual water district it serves.

Additional Information

Since this analytical description of the Portland Water District defense was presented on February 10th, two of the concluding suggestions have been definitely proven.

There appears a better understanding of the importance of coordinating water supply in the military defense, especially in the passive resistance phase of civilian defense.

The other suggestion was possibly termed, at the time, "An Hysterical Hyperbole," from the fanatical idea that water *could be* an essential war implement. However, Singapore's fall could be definitely predicted when the Japs captured all but one of the reservoirs supplying the city, and the defenders, unable to counter-attack, could not regain them. With this condition, the filtration of defeat and surrender was visualized.

Also, to be corrected is the statement that water is *not* an offensive weapon. Fact is, the Russians are now using a high pressure pump apparatus to spray the German troops with water, which at the freezing temperature of Russia completely immobilizes the enemy.

In conclusion, let me say, too, that the District is providing two gasoline engine driven portable pump units to be used in emergency to augment the source of supply, if such becomes necessary because of the continuation of deficiency of precipitation, or for any other reason such portable units are needed. These two units are estimated for a 5,000,000 gal. daily capacity and probably will cost around $15,000.00.

What Seems Obvious May Not Be

In your surveys and in setting up your defenses, let me give you a maxim to use. From a book by Prof. Edward S. Farrow, former Instructor of Tactics at West Point, the following has been taken—

"What is obvious is not always known."

"What is known is not always present."

Let me give you an illustration of the fact that this is frequently the case. During my checkup on stations in the main building, I saw a first aid kit on a post. It was obvious what it was for—it was plainly marked. Well known, for every one had seen it for a couple years or more (its red cross and sign saying "First Aid") but when I opened it there was nothing but space inside. I think you can realize the significance of not accepting either the "obvious" or the "known" in defense planning and preparation.

Then, too, let me give you another thought. If this maxim had been adopted by both the Navy and the Army on that group of islands in the Pacific, not so long ago, who can say but that it would not have been half so painful to recall what happened to create the war cry—

"Remember Pearl Harbor."

The Importance of "Wrap"

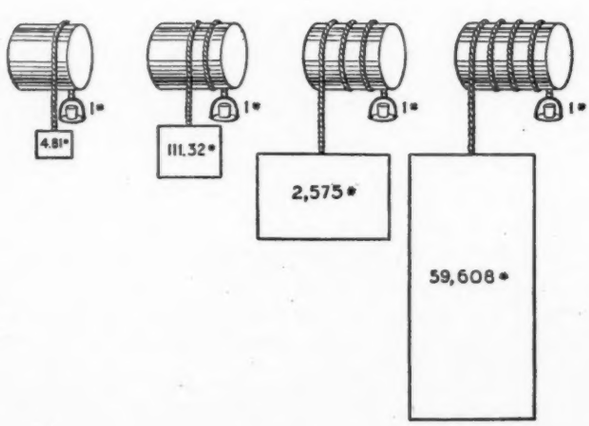
Here is a sketch that shows clearly the importance of "wrap" as applicable to drums, sheaves, and pulleys. Also the importance of "wrap" in holding trees or poles from falling, lowering of heavy objects, etc.

The first sketch at the left shows a rope slung around a drum and embracing 90 degrees arc of contact. That is, the rope goes "half around." The coefficient of friction of the rope is 0.5. Under such conditions a one-pound weight on one end of the rope will support 4.81 pounds on the other end of the same rope due entirely to the rope's friction and the arc of contact.

In the second sketch the rope embraces the drum 1.5 times. The same one-pound weight will now support 111.32 pounds on the other end of the rope.

In the third sketch the rope embraces the drum 2.5 times and the weight supported jumps to 2,575 pounds.

And in the fourth sketch the rope embraces the drum 3.5 times and the weight supported by a 1 pound



pull advances to the astounding figure of 59,608 pounds.

We have all seen boatsmen quickly grab a rope, wind it around a drum a few times, pull it up taut, and hold a huge liner without the least rope slip. These figures explain why the rope does not slip. We have seen one man lowering away very heavy objects by using the "wrap-and-slip" method of release.

These figures also explain why a wrapper pulley which increases belt contact on a pulley is often so important on a belt drive.

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*Explained by W. F. Schaphorst, M. E., Newark, N. J.

N. J. SEWAGE WORKS ASSN'S 27th CONVENTION

Adopts New Constitution and Votes to Join Sewage Works Federation

By HARRY A. FABER*
Associate Editor

IN STRANGE contrast to what happened a year ago when the vote was 9 to 1 against the proposal, by unanimous vote members of the New Jersey Sewage Works Association decided at its recent meeting to join the Sewage Works Federation. This historic step was taken at its twenty-seventh annual meeting in Trenton, March 5th and 6th. In addition, the Association adopted a new constitution, listened to technical papers of timely importance, took part in a symposium on the collection and disposal of grit and sludge, and confounded the experts on a "Sewage Please" question box program, as well as being happily entertained at the usual speechless dinner.

Presidents

(Retiring) *Sam R. Probasco* *City Engineer* *Burlington, N. J.*

(Incoming) *Henry Vander Vleit* *Supt. Public Works* *Maywood, N. J.*

Association in Excellent Shape Financially

Treasurer Paul Molitor, Jr., reporting on finances of the Association, revealed for the year:

Income	$3,287.46
Expenditures	2,918.00
Cash Balance	$ 369.46

which cash balance, said Mr. Molitor, was the highest in 8 years.

In reporting on expenses in connection with the new Tenure of Office Act* for the protection of water and sewage works operators in New Jersey, Mr. Molitor revealed that these expenses had been borne jointly by the Sewage Works Association and the New Jersey Section of A. W. W. A. The Sewage Works Association's share of $1,300 had been paid from special member contributions and funds from other sources, the last $126 being raised by conducting a raffle of a $50 Defense Bond.

[*The New Jersey Tenure Act is to be found printed in full on pages 330-331 of WATER WORKS AND SEWERAGE for July, 1941.]

The New Constitution

A revised constitution, drafted for the purpose of harmonizing with that of the Federation of Sewage Works Association, and permitting America's oldest sewage works association to affiliate with the new National Federation when and if expedient to do so, was introduced, discussed at some length by members and thereafter accepted by unanimous vote.

The new constitution of the New Jersey Association is drawn so as to preclude any changes in the conduct of the Association as now run or to necessarily change the status of any member or to raise dues from the present $2 per year figure, except for those members who elect to become "Subscribing Members," meaning that such members pay an extra $3 per year dues, which is turned over to the Federation to pay the annual cost of subscription to the Sewage Works Journal. As to the status of the non-subscribing members in the affairs of the Association, these members have the same vote and all other privileges as the "Subscribing Members," who pay the $5 membership dues.

Vice-Presidents

John W. Collum *City Engineer* *Bordentown, N. J.*

Lou. Fontenelli *Supt. Treat. Wks.* *Rahway, N. J.*

Two other interesting sections appear in the constitution. One section fixes the location for annual meetings as Trenton, thus requiring a change of constitution to alter the meeting place. The other section insures that the Association will continue to be first and last an operators' association run by and for sewage works operators. This section states: "Only such members as are *actually engaged in the operation of sewage treatment works, and are licensed under the laws of the State of New Jersey* for such operation, shall be eligible to fill any of the aforesaid offices of the Association."

This section is not new in the constitution of this Association, which

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

On With the Show

(1) The President, Sam Probasco, holds up the show while leading the gang in "Sweet Violets"—theme song of N.J.S.W.A. Conventions. And, did Sam do his stuff? (2 and 4) The show is on, Gentlemen—the camera being too close to get all of the pulchritude in. (3) The "Speechless Dinner" for which the N. J. Conventions are famed. (5) Alan "Dorrco" Darby picking up one of the gals with whom he danced "Bumpsy Daisy" too enthusiastically—but he didn't mean to be so "Bumpsy."

has been run by and for plant operators since its inception 28 years ago. It has worked well and deserves attention.

Resolutions

Upon adoption of the new constitution, Edward F. Shissler, Supt. of Public Works at Haddonfield, N. J., a past president and "wheel-horse" in the Association, was quick to introduce a resolution that the New Jersey Sewage Works Association accept the invitation, which was tabled in 1940, and to become a member of the Federation of Sewage Works Association if the new constitution proves acceptable to the Federation. The resolution was approved by unanimous vote.

Prior to passage of the resolution, Dr. W. Rudolfs, representing the New Jersey Sewage Conference on the Federation Board of Control, very magnaminously stated that if the affiliation was consummated that his group would disband and members therein would for the most part if not wholly become members of the New Jersey Association.

A second resolution of importance was introduced by Arthur E. Bell, Borough Engr. and Supt. of Essex Fells, N. J. This resolution empowered the officers of the Association to retain legal counsel for case interpretations involving application of the new Tenure of Office Act to individual cases brought to the Association's attention. And as soon as a desirable case appeared justifying making of it a test case for the courts, that action in this direction be instituted.

New Officers

The New Jersey Association makes the practice of electing a President and a new Second Vice-President every second year only. This being election year, the following officers were either promoted a stage, elected new or reappointed.

Programmers
G. Russell Hartley, City Engineer, Englewood, N. J.

Ralph H. Holtje, Asst. Engineer, N. J. State Dept. Health, Trenton

C. J. Velz, Prof. of Sanitary Engineering, Manhattan College, N. Y. City

President
Henry Van der Vleit,
Supt. of Public Works,
Maywood, N. J.
First Vice-President
John W. Collum,
City Engineer,
Bordentown, N. J.
Second Vice-President
Louis Fontenelli,
Supt., Treatment Works,
Rahway, N. J.
Secretary
John R. Downes,
Supt. of Treatment Works,
Plainfield, N. J.
Treasurer
Paul Molitor, Jr.,
Supt. of Treatment Works,
Morristown, N. J.

Technical Papers

"Biology of Sprinkling Filters," by Ralph H. Holtje, Assistant Sanitary Engineer, New Jersey State Department of Health, Trenton.

Using an exceptionally complete collection of lantern slides, Mr. Holtje illustrated the complex community life of microorganisms existing in a sprinkling filter. He pointed out that materials providing food for one group of organisms are toxic to another group; that each group must struggle for its own interests, mutual cooperation in this low scale of life being purely involuntary.

Some filter-stone film contains as many as 300 million microorganisms in each cubic centimeter. A zoogleal mass may contain several types of bacteria, holding colloids in contact with the film, but utilizing for food only materials in true solution. Not all bacterial masses are attached, some actually moving through the filter. Filamentous bacteria may be relatively large; sphaerotilus, for example, is about 1 micron or one twenty-five thousandth of an inch in width.

Competing with bacteria and using generally the same food supply are many forms of fungi, molds and protozoa. Prevalence of fungi over bacteria is due to conditions such as temperature, fungi growing more extensively in winter. Protozoa are frequently able to cause a rapid changeover in bacterial population and thus affect purification. Worms are normally soil organisms but may be so abundant in filters in the spring as to cause sloughing. Algae may grow extensively as a surface mat and bring about ponding.

For control of psychoda flies, flooding is the most generally applicable method. The New Jersey Department of Health recommends holding a flooded filter for a maximum of 36 hours (for shorter periods if aerobic action is injured by the 36 hour holding) and repeating every ten days. Larvae of these flies may also be destroyed by other methods. In discussion following the presentation of this paper, a chlorine dose sufficient to give a good residual in the applied sewage was recommended as another control method, but Mr. Holtje said this should be used with care so that other organisms would not be injured too extensively. It was pointed out that if the chlorine dose is below a killing dose for the nitrifying organisms, the curve of nitrification may actually rise pronouncedly after chlorine treatments, such being the experience at Schenectady and elsewhere.

"Dick" Ockerhausen
General Chemical Co.
New York
and
Paul Cerny
Pacific Flush Tank Co.
New York

"Buster"
(A. B.) Terhune
Multiplex Concrete Pipe Co.
East Orange, N. J.
"Hank" (H. B.) Clark
George Chemical Co.
New York
John Horgan
Ralph B. Carter Co.

Panel of Experts
on
"Sewage Please"
Bell (Essex Fells)
Lehmann (Hackensack)
Kachorsky (Manville)
Adams (Tenafly)
(At the "mike" was Fontenelli of Rahway.)

Stanley Applegate
Supt. of Sewerage
Neptune, N. J.
J. Kenneth Van Brunt
Supt. Water and Sewerage
Manasquam, N. J.
Clarence C. Cornelius
Supt. Water and Sewerage
Sea Girt, N. J.

"Dick" (R. E.) Wagner
Engineer
Zeolite Chemical Co.
Medford, N. J.
and
"Mike" (I.M.) Glace
Consulting Engr.
Harrisburg, N. J.
(Director-Elect. A.W.W.A.)

"Ironing Out the Operation of the New Activated Sludge Plant at Hackensack, N. J.," by A. F. Lehmann, Superintendent of Works, Hackensack, N. J.

To replace two old and inadequate Imhoff plants, this new activated sludge works was placed in operation during April of 1940. It serves a population of 25,000 and handles an average flow of 2.75 m.g.d. The B. O. D. of the sewage averages 223 p.p.m. Apparently many more faults of design and construction than are normally expected required correction in this plant. Mr. Lehmann pointed out that the remedies had not all been found or accomplished, but that considerable progress had been made.

The primary digester provided a holding period of only 7 days until it was learned that activated sludge of 1 per cent solids could be obtained by maintaining a two-foot depth of sludge in the final clarifiers. Digester supernatant has been the cause of much experimentation. At first it was returned to the primary clarifiers as raw sludge was pumped to the digester. This, together with waste activated sludge, caused bulking in the primary clarifier. Experiments with ferric chloride and with chlorine treatment of supernatant proved of little value, and a lagoon was built. Study has led to the present method of applying supernatant, two or three times daily, to sand beds. Sludge blanket in the final clarifier can now be maintained at only a few inches.

Concentration of solids in the mixed liquor has been varied experimentally from 900 to 3,500 p.p.m. For over a year, the maintenance of a 1,000 to 1,200 p.p.m. concentration has proved very satisfactory. By holding dissolved oxygen to a minimum of about 1.0 p.p.m. in the aerator effluent, no bulking troubles have occurred in nearly a year. In the early days, however, a high sludge index required heavy chlorination of returned sludge in order to correct bulking. The return sludge proved to have a chlorine demand of about 75 p.p.m. and the effective

P. N. Daniels
Supt. Sewage Treatment
Trenton, N. J.
(In Charge of Meeting Arrangements)

Edw. F. Shissler
Supt. Public Wks.
Haddonfield, N. J.
(A "Wheel-Horse" Past-President)

chlorine dose used was 12 per cent of the total demand.

Only recently have industrial wastes been considered as a possible cause of bulking troubles. During the summer of 1941, river water was pumped for dilution of the strong dry weather sewage, and it is recognized that this may have been of material aid in better operation.

Maintenance costs of the sludge pumps has been high, averaging about $650.00 yearly, and air lift is being considered for return and waste activated sludge.

For some time no heat was available to heat the digesters. Even since heating became possible, good digestion does not occur in cold weather, the best possible temperature in one digester being 76° and in the other 82°. This condition may be solved by reducing the volume of sludge handled, by increasing the number of heating coils or by providing a larger hot water pump. Continuous operation of the mixer on the digester is necessary.

Sludge from digesters was sufficiently thick after three months to start vacuum filtration. Extensive study of coagulants was required, since even 15 to 20 per cent ferric chloride produced a thin cake. Operating ten hours daily did not adequately handle sludge production. It was learned that the pH must be maintained at 11.5 in order to accomplish good filtration, and this requires 30 to 35 per cent lime. Life of the filter cloth averages 217 hours. Cloth blinding was formerly reduced by brushing with 10 per cent hydrochloric acid, but now is accomplished more effectively by providing a shallow pan of this acid and revolving the cloth through it.

An attempt is now being made to reduce the volume of sludge sent to digesters through the use of one aeration tank for "aerobic digestion" of wasted sludge. Ultimate disposal of sluge may require flash drying.

Paul Molitor, Jr., Supt., Morristown, N. J., in discussing this paper, noted that relatively few plants are designed to handle combined sanitary and storm flows. In the case of the Hackensack plant, all flow above 6.0 m.g.d. is separately discharged through the old Imhoff plant. At Morristown, flushing of sewers in dry periods has proved helpful and is regularly used to bring a more dilute and fresher sewage to the plant. The study of "aerobic digestion" at Hackensack will be watched with much interest.

L. H. Enslow and *John R. Downes* both gave high recommendation for the use of dilution water either in activated sludge or trickling filter plants during periods of hot weather and low sewage flows. Each was highly complimentary of Mr. Lehmann's industrious and carefully thought out attack of his several problems at Hackensack, his paper showing clear evidence that the author had not been off picknicing much during the past summer, nor sparing of midnight oil.

"The Preparation of the Yearly Budget for the Operation of Sewage Treatment Plants," by E. De Witt Rush, Superintendent of Treatment, Sayreville, N. J.

With the explanation that this paper is expected to provide only certain fundamental facts regarding such budgets and is to be followed by more detailed papers in the future, Mr. Rush surveyed general considerations which must be recognized.

To indicate the necessity for a planned budget, he cited experiences at Sayreville in which chemical treatment of sewage was required by the

Kermit DeVoe
Supt. Treatment Wks.
South River, N. J.
and
Michael Kachorsky
Supt. of Public Wks.
Manville, N. J.

J. F. Boreiszo
Chemist
Rahway, N. J.
and
Joseph Strahan
Plant Supt.
Asbury Park, N. J.

Roy Glantz
Supt. Sewage Plants
Ft. Meade, Md.
and
Carl A. Arenender
Malcon Pirnie, Engrs.
New York

Vernon Casler, Supt.,
Dept. Public Works,
Seaside Heights, N. J.,
and
J. V. Van Kirk, Supt.,
Sewage Treatment Works,
Seaside Heights, N. J.

Alan Cooper, Chf. Opr.,
Sewage Treatment Plant
Fort Dix, N. J.,
and
"Len" L. Langford,
"P.F.T." Engineer,
New York City

State Department of Health during a part of the year. No funds for chemicals had been included in the appropriation, even though it was known that chemical treatment would be needed at times.

State requirements, new equipment, availability of materials, personnel, and conditions which differ from one year to the next must all be considered. They all contribute to prevent a standardized budget from being satisfactory. The personnel factor is of immediate importance since the loss of some men is likely to follow wage rises in industry. Thus, 1942 costs cannot generally be based on those prevailing in 1941.

Considerable saving may be accomplished by improved methods of handling materials, by reductions in power costs, and in depreciation. Only through knowledge of cost and efficiency of various operations can economies be introduced. Increases in the cost or degree of treatment with increased discharges of industrial wastes should be provided for in a contingency fund.

A higher cost of good material (if it is the proper one for the job) frequently prevents larger costs later. Maintenance and repair work by plant operators should materially reduce operating costs. However, it should be clearly recognized that operators have their limitations and that some jobs are for specialists.

"Financing Sewage Treatment Works Operation, in Relation to Public Health," by Prof. C. J. Velz, Head, Civil Engineering Dept., Manhattan College; Water Consultant, National Resources Board, New York City.

Professor Velz decried the popular misconception that sewage worries are ended merely by the building of a treatment plant. He pointed out that the only public return for this investment is in the good product produced, hence, in clean streams. He advocated making every individual feel personally concerned with proper plant operation by translating it into terms of recreation, public health, and industrial benefits.

Arthur E. Bell, Boro Engr. and Supt. Essex Fells, N. J.

J. K. Adams, Supt. Treatment Wks. Tenafly, N. J.

Thos. R. Komline, Asst. Supt. Plainfield Joint Treatment Works

Stable and adequate funds must be derived by one of three methods.

Least generally used is the cooperative Joint Meeting and industrial plan which provides a stable source of funds but which is beset by difficulties in insuring a high calibre of leadership. Sewer rental or service charges constitute a recent method, but one that is difficult of initial establishment. Funds for operation of the majority of plants must still be derived from general taxation—a somewhat precarious, irregular and unsatisfactory method.

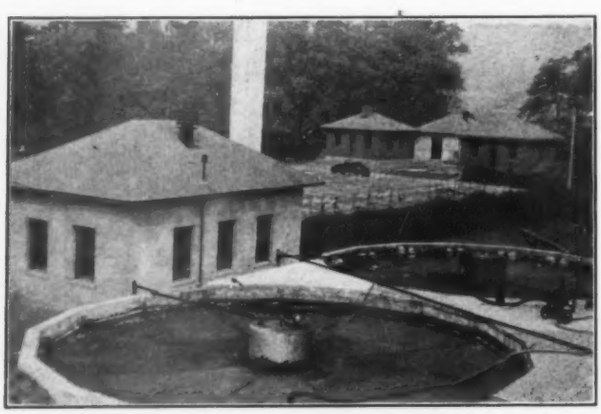
Two new means for better operation were proposed by Professor Velz. Intensive decentralized supervision and technical facilities might be provided in order to aid officials in budget preparation. Cost of financing and cost of technical services could be reduced in this manner. As another method, a state or referee board might set the proper amount required for operation and require its inclusion in the municipal budget. To do this, a report of operating expenditures would be required.

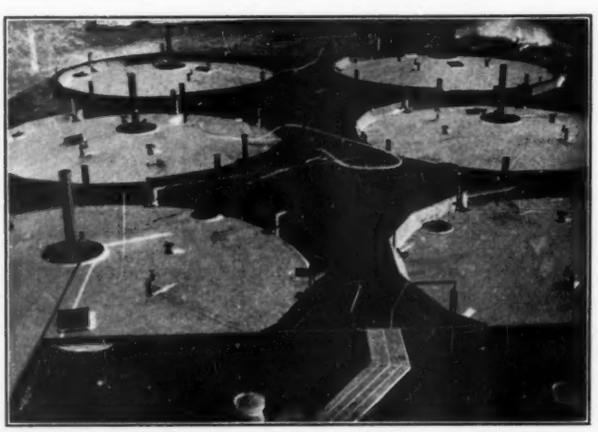
No matter what method of obtaining funds may be used, they will never be more adequate than the public is willing to provide. To make the public willing, sewage treatment must be sold to the public by dramatization. The value of advertising, of newspaper and radio publicity, of contacting civic groups, and of plant visits were described as methods of obtaining backers for sewage treatment budgets. In the author's opinion, the development of ways and means to accomplish this end by the New Jersey and other associations would be well repaid, and more adequate operating budgets would be realized through such efforts.

"Determination of Expected and Actual Flows in an Existing Sewer System," by G. Russell Hartley, City Engineer, Englewood, N. J.

With a premonition that as designer of Englewood's new sewage treatment plant he would also have something to do with its later operation, Mr. Hartley stated that he had put operation problems foremost in the design. To provide adequate flow records he had to sell the Sewer Board on spending $35,000 additional for metering equipment.

In the plant and pumping station design it was necessary to have some reasonably dependable flow data. Taking the metered water consumption of 55 gals./capita/day and the measured sewer flows of 76 g.c.d.





A Picture of Yesterday and Today at the Plainfield, N. J., Plant

A partial story of the evolution of the Downes Floating Covers is told in these two pictures. The earliest floating cover for sludge digesters, conceived and developed by Supt. John R. Downes at the Plainfield Joint Treatment Works, was a square affair. The picture on the left shows the second progress step, involving wooden covers for what was approaching a circular digester. The gas dome on the right tank was a rectangular affair with a hinged lid. Then came the more finished cylindrical dome in the early 1930s.

The picture on the right shows Plainfield's battery of digesters equipped with the 1942 model of Downes—P.F.T. Floating Covers constructed of steel.

(1) *W. J. Shivera, Supt. Public Wks., Freehold, N. J.*
(2) *Louis Milani, Supt. Sewerage, Hasbrouck Hgts, N. J.*
(3) *David Carmichael, Boro Engr., Verona, N. J.*
(4) *Leroy Gaul, Supt. of Sewerage, Wildwood, N. J.*
(5) *H. O. Pruden, Asst. Clerk, Morristown, N. J.*
(6) *Wm. R. Lafferty, Supt. of Sewerage, Lakeland, N. J.*
(7) *John G. Albertson, Associate, T. F. Bowe, Engrs., New York*

from an old trunk sewer, the infiltration of 21 g.c.d. proved to be 1 gal./ft./day. Other sewers were measured in the same manner to obtain an expected average of 1.4 m.g.d., which 2 months of pump station operation had revealed to be practically the same.

Concerning sewer maintenance experience, Mr. Hartley considers it a worthwhile policy to answer house calls for help in unstopping choked house laterals. Such inspections have uncovered many important surface water leaks into sanitary sewers which have been corrected incidental to treatment and pumping. The survey for sewer leakage has also uncovered over and undersized sections of sewer. The survey has also revealed that the matter of sewer grade is of less importance than usually thought. Mr. Hartley cited an 18 in. sewer laid to grade of only 1 in. in 1,000 ft. which has functioned for years without difficulties. After 2 years without cleaning, a screw run through this sewer yielded only some grease. It is his belief from survey observations that on the whole grease restricts sewer flow more than roots or silt. Mr. Hartley also referred to his good fortune of having an old workman on the leakage survey job who had grown up with the system and from his "memory-map" could point out where the bad construction was to be found. Anybody with such a "Charlie" on the job was fortunate.

Surveys for night flows are under way now to locate further leakage which Mr. Hartley finds to be more prevalent through lateral connections than through trunk line joints.

The connection leaks are located by observing flows at manholes while using a sewer plug on a flexible sewer rod for blocking off one connection after another while making the manhole observations.

For the Englewood system with a recorded metered water consumption of 52 g.c.d. and a minimum infiltration of 10 to 25,000 gals./mile of sewer, the normal flow reaching the pumping station is 68.5 g.c.d.

Leslie West, Chief Engr., Elizabeth Valley System, pointed out that in storms flow through manhole covers had been found to reach important proportions.

Grit and Sludge Collection and Disposal

A Symposium
Lead by Louis Fontenelli
Sup't of Treatment, Rahway, N. J.

Mr. Fontenelli in opening the symposium on the "Collection and Disposal of Grit and Sludge" recited a number of plant operating and maintenance difficulties which improvement in design would have avoided. He decried the use of stop-plank for blocking off channels instead of non-leaking screw-gates. Grit handling equipment not housed freezes up to give much trouble. The vacuum relief mechanism on gasometer type digesters should be well above flow line to preclude fouling by sludge or scum spatter. Those at Rahway had to be raised.

In two stage digesters at Rahway the supernatant liquor question remains a problem. Although from the secondary digester it contains 1,000 p.p.m. suspended solids and disposal on sand beds is the overall best scheme. Because of digester overloading the secondary sludge is watery and the addition of alum during drawing, to produce coagulation and solids flotation, has proved a marked aid in speeding dewatering and thus increasing sludge bed capacities. As much as possible of the wet sludge is disposed of on farm areas by haulage and distribution from tank-trucks. In winter sludge is stored as much as possible.

Concerning the alum treatment of sludge or supernatant, Mr. Fontenelli explained that 150 lbs. of filter alum is dissolved in 50-gal. oil drums located near the splash-blocks of the sand beds. The alum is fed as the sludge falls to these blocks, the rate of feed being set by visual appearance of the sludge. The rate sufficient to give the curdling effect desired (clear liquor running out ahead of the "curds" on the bed) is about 1/10th lb. of alum to each cu. ft. of sludge, the higher the solids in the sludge the more effective the dosage. Since sludge-quality varies even during a single drawing the dosage control remains a matter of operation judgment based on appearance and experience. The major effect of the alum is that of flotation. The colloidal solids, which otherwise blind the sand surface, are flocculated. Mr. Fontenelli emphasized that adding the alum solution at a point to insure the quick, thorough mix immediately before flowing into the bed had proved the most effective scheme, over-mixing being deleterious.

"Experiences at the Plainfield Plant," by Thos. R. Komline, Asst. Supt., Plainfield, N. J.

Mr. Komline, reviewing the history of grit removal and handling schemes tried at Plainfield, reported that the rag problem had defeated schemes involving grit removal from the chambers by air lift, and by bucket and screw conveyors subsequently tried. The present scheme is a detritus tank (13-19-22 ft.) with two hoppers. In the bottom of the hoppers a perforated air line is used to stir the deposits and allow the finer materials to wash out. Removal of deposits is conducted with an orange peel bucket on a swinging crane boom which is handled by one operator. Removals of 19.8 cu.ft./day is the average, the material being disposed of in an old burrow-pit without nuisance, or it is spread on the farm land and covered with furnace ash. The sewage flow varied from 1 to 7 m.g.d. through the detritus tank which has been used now for 14 months with satisfactory performance.

Sludge from the digesters is either floated with alum in shallow tanks and converted to fertilizer in the spray-drier or tank-trucked to the farm, run into furrows and covered. Lantern slides pictured the

specially designed sludge tank truck drawn by a tractor.

Plainfield supernatant liquor is thickened in separate tanks, the sludge from the thickening operation containing 6% solids.

"Experiences at Rutherford, N.J." —by Albert B. Kozma, Supt. of Treatment, Rutherford, N. J.

The Joint Disposal Plant of Rutherford, East Rutherford and Carlstadt, N. J., treats a sewage which is 33% industrial wastes and averages 400 to 450 p.p.m. suspended solids. The clarifiers are covered tanks 84.6 ft. long by 28 ft. wide and are equipped with Dorrco "Monorake" sludge and scum removal mechanism. Through the clarifiers 375 p.p.m. suspended solids are removed, the sludge averaging 5% solids and requiring daily pumping of 21,000 gallons containing 7,800 lbs. of dry solids for 2.5 m.g.d. of sewage.

The Dorrco Monorakes deliver a batch of sludge to the hoppers every 20 minutes and sludge pumps were regulated to just empty the hoppers every 20 minutes to keep in step with the Monorake delivery as nearly as practicable. However, it has been found that a denser sludge is obtained by alternating the pumping of hoppers at 30 minute intervals.

A more recent refinement consists of a pumping schedule based on the settleable solids removed during a previous 24 hours, as revealed by the laboratory records. That is, the number of o.c.s. of solids separating from 1,000 c.c. of the composite sample of crude sewage of "yesterday" multiplied by 1,000 gives the gallons of 5% solids sludge which can be pumped from the primary tanks "today." The pumping schedule is set according to this figure and seems to be a more satisfactory control. The other control is the depth of sludge permitted to accumulate in the clarifiers—a 6″ depth appearing to be optimum for best overall results and operating economy. Sludge depth is approximately revealed by a spring tension indicator hooked into the hauling cables of the "Monorake."

Programmers

(1) *A. F. Lehmann, Supt. of Treatment, Hackensack, N. J.*
(2) *Albert B. Kozma, Supt. of Treatment, Rutherford, N. J.*
(3) *Joseph Strahan, Plant Supt., Asbury Park, N. J.*
(4) *E. De Witt Rush, Supt. of Treatment, Sayerville, N. J.*
(5) *John Struss, Plant Supt., North Wildwood, N. J.*

Mr. Kozma said that much of benefit, all around, had resulted from the attention given the clarifier operation and sludge transfer schedule. Not alone had the digesters shown the effects, but likewise the quality of primary effluent. In all of this work the quick procedure for solids determination published by Dr. George Symons of Buffalo in WATER WORKS AND SEWERAGE for June, 1941, and the improved method published in January, 1942, had been of considerable value in simplifying the laboratory work and giving a greater volume of data much more quickly than heretofore had been possible.

"Experiences at Asbury Park, N. J."—by Joseph Strahan, Plant Supt., Asbury Park, N. J.

Mr. Strahan, an eminently practical plant operator, asks only the materials needed to do a job and it's done. In a treatment plant built under the Asbury Park boardwalk and street, Mr. Strahan was confronted with an odor problem of the first order (or was it odor?) and did something about it. He drew all of the sewer gases from the settling tank by suction. In applying chlorine at the tank inlet he raised the solution hose sufficiently above surface to secure a liberation of some chlorine into the space between the sewage surface and tank roof. Thereby the gases were chlorinated as well as the sewage. Up the stack—of flagpole design—went the chlorinated gases and odor complaints ceased. With his intake pipes from the tank to the exhaust fan he had some trouble from chlorine eating through the top at spots. To keep everybody happy he would patch these spots and turn the pipe 45 degrees. Then sooner or later more spots to patch and another 45 degree turn of the pipes. Now he's about ¾ths the way around and will need some W.P.B. assistance in getting replacement pipes before many more months. However, he did not seem worried about what these light weight pipes cost when considering the benefits from the scheme.

Another Asbury Park problem (not unknown to other seaside places) has been fine sand in the sludge. This circumstance precludes slow pumping to secure the most dense sludge. And, he was vociferous in his condemnation of baffles in a digestion tank because of the dead areas created.

"Experiences at North Wildwood, N. J."—by John Struss, Supt. of Sewerage, North Wildwood, N. J.

Mr. Struss also knew something of the problem of grit or silt in sludge. In spite of all that had been done to remove grit the air sludge lift "couldn't take it." The solution worked out was to provide a fish tail jet to loosen up the sludge-grit deposits in the settling tank hoppers. This spray nozzle is supplied with plant effluent under 40 lbs. pressure and is turned 360 degrees by the operator, using a handle at the top of the tank, before starting the air lift and is kept in operation during the time that sludge is being transferred.

[We would add that Mr. Struss also puts to other good uses the plant effluent which is distributed around the North Wildwood plant under 40 lbs. pressure for general use where high cost water was formerly used. Amongst other things the effluent supply is used for operating the ejectors of the vacuum type W. & T. chlorinators, while fresh water is used as the tray supply.]

(1) *Daniel Meyer, Chemist, Bakelite Corp., Bound Brook, N. J.*
(2) *T. W. Trautwein, Sales Engr., "Sea-Ro" Packing Co., Wood Ridge*
(3) *"Bill" Flanders, Sales Mgr., Worthington-Gamon Meter Co.*
(4) *Carlton Roberts, Dir. Public Wks., Asbury Park, N. J.*
(5) *Eric Hartmann, Vice-Pres., Inertol Co., New York*
(6) *"Steve" Whitby, Sales Engr., Chicago Pump Co., Philadelphia*

Sewage Please!

Conducted after the manner of "Information Please," the Association's question box proved to contain several difficult inquiries. At least the board of five experts cost the treasury three dollars and a half for answers judged wrong by the "Master of Ceremonies," *Don M. Ditmars,* Assistant Sanitary Engineer, State Department of Health.

The experts: *Art Bell,* Essex Fells; *Michael Kachorsky,* Manville; *A. F. Lehman,* Hackensack; *Louis Fontanelli,* Rahway Valley; *J. K. Adams,* Tenafly.

Some of the questions and answers:

Q.—What are three methods of determining pump overload?

A.—By electrical testing instruments, by a rise in motor temperature, and by the kicking out of circuit breakers or burning out of fuses.

Q.—What are steps which should be taken when a pump rate decreases?

A.—See if inlet is clear and glands are tight; check wearing rings for need of replacement; outlet line may be blocked; or the impeller may have become clogged with rags or other fibrous materials.

Q.—In the biofiltration process does the filter produce a nitrified or oxidized effluent?

A.—Effluents contain little if any nitrates, but there is oxidation.

Q.—Name at least three theories explaining the action of chlorine on sewage?

A.—There is first a germicidal action, a reduction of oxygen demand, and under the proper conditions grease is separated.

Q.—How should a centrifugal pump be rigged up to provide a suction lift on sludge?

A.—A continuous prime must be included, and this must be done without permitting a cross connection. By having an elevated open tank to supply water and by using a ball float connection to the potable supply to the tank this may be accomplished. It is also possible to use a positive displacement pump to create the necessary vacuum.

Q.—What method of supernatant disposal is best?

A.—This is an individual problem at each plant. Some methods are: heavy chlorination and return to primary tank, discharge to sludge drying beds, return to aeration tanks if sufficient aeration capacity is available.

Alan Drake Back Home as Buffalo's Director of Water

Alan D. Drake

Alan D. Drake, former Director of Water for Buffalo, N. Y., has been called "back home" to resume the position which he held up to 1938 when the spoils of politics resulted in a good man being out of a job.

With the appointment of Newell Nussbaumer as Buffalo's Director of Public Works little time was lost in getting Alan Drake back into his old job which he had handled commendably. To us, and many others who came to know Alan Drake, this is more good news added to that telling of the appointment of Mr. Nussbaumer, as Director of Public Works, Buffalo, such being strictly a career appointment.

Mr. Drake had for several years been active in the affairs of the American Water Works Association during his tenure as Director of Water Works for Buffalo and had served as Chairman of the New York Section of A.W.W.A. For his services to the Association as Chairman of the Local Arrangements Committee he was honored during the Buffalo Convention and presented a special token of appreciation.

Up to March 1st, when he returned to Buffalo, Mr. Drake held the position of Service Engineer, Airport Section, Corps of Engineers, U. S. Army.

Anyway, It Makes a Good Story

We have just run across an Associated Press release which we are passing on to you for a chuckle. It comes from Richmond, Va., and you can believe it or not—mostly NOT will be our guess. Anyway, it makes a good story—and here it is:

> "Down at the city gas and water offices, 1613 Park avenue, is just 1613 Park avenue in the matter of listings. So when the gas and water bill for that address became overdue off went the water and off went the gas.
>
> "Richmond's public utilities director, J. A. Hobson, Jr., of 1613 Park avenue, said he mislaid the bill and just forgot the matter. But he had to pay up before service was restored."

P. S.—We wonder if the Director could just have "planned it that way" to show that the Richmond Dep't of Utilities meant business, and played no favorites in its collection of charges for utility services.

Charlie Capen Made Chief Engineer

Chas. H. Capen, Jr.

Chas. H. Capen, Jr., has recently been promoted by the North Jersey Water Supply Commission to the position of Chief Engineer.

Mr. Capen has been connected with the North Jersey Commission since 1925, and, at the time of his promotion, was on leave serving the U. S. Army as Principal Sanitary Engineer for the 2nd Corps Area, U. S. Engineers.

Charlie Capen was born on Nov. 1, 1895, in Jersey City, N. J. Upon graduation from Cornell University in 1917 he joined the staff of J. N. Chester, Pittsburgh Consulting Engineer, and later became associated with Nicholas R. Hill, Consulting Engineer of New York. He then went with the N. J. State Dept. of Health as Assistant Engineer, after which service joined with P. N. Daniels of Trenton, N. J., and became a consultant on his own under the firm name Daniels and Capen. With the North Jersey Commission he continues to serve other communities as consultant.

Mr. Capen, well known in New Jersey, has been active in the N. J. Section of A.W.W.A., which only recently honored him with the Geo. W. Fuller Award for conspicuous service and later made him Chairman of the Section. He has also been a "wheel-horse" in the New Jersey Sewage Works Association, almost since its formation. He is a conspicuous contributor to the technical literature and association programs, and is a productive member of A.W.W.A.'s Publication and Program Committee. He is also a member of the Am. Soc. of Civil Engineers and other professional groups.

Mr. Capen has served as consultant for the State Water Policy Commission of N. J., and has rendered valued service to Governor Edison and his special Emergency Water Supply Committee.

As a valued contributor to the pages of "Water Works and Sewerage" during a period of years we are especially happy to see Charlie Capen's worth appreciated in this long deserved promotion—more evidence of a new trend in appointments in the municipal water and sewage fields.

SEWAGE SLUDGE SALES AND $ $ $ RETURNS

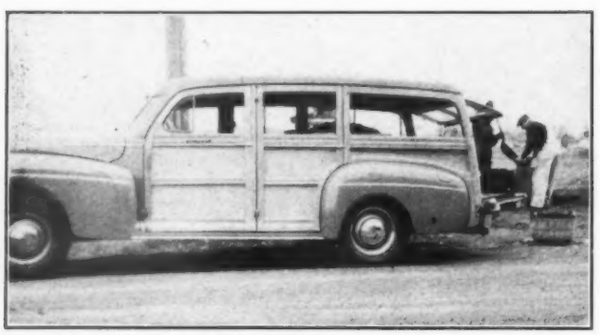
Also the Place of Sludge Fertilizer in the War Economy

By ROBERT W. FRAZIER
Superintendent
SEWERAGE COMMISSION
OSHKOSH, WISCONSIN

SLUDGE derived from the treatment of sewage is a so-called by-product. In the minds of some operators it is just a "waste material." To these operators, disposal of this material is considered a problem. To the contrary, however, the product has a financial and fertilizing value which too few operators fully realize.

The Author

An operator can help his cause along by expending a little effort in the direction of advertising this product as a fertilizer. In this I do not refer to commercial advertising, but advertising in a general sense by whatever means he may develop. The funds derived from sludge marketing will help him out in purchasing tools and equipment that he knows he needs but cannot purchase because his budget or allowance is too limited, and he hesitates to ask for "extras." Sludge marketing will also help his community prestige by advertising his plant and make it easier to reach the public and show those who pay the cost what sewage treatment is. It is to be understood, of course, that a sewage treatment plant is what its name implies and too much stress cannot be placed on the conditioning and sale of sludge as a fertilizer because it would be unfortunate should the plant become known as a fertilizer plant rather than a sewage treatment plant.



Making a Delivery of "Oshkonite."
Otherwise Ground Sewage Sludge Carrying the Local Label.

Oshkosh Experiences

In order to bring out the points in question, perhaps the most effective method will be to recite some experiences gained at the Sewage Treatment Plant of Oshkosh, Wis., in bringing sludge values to the attention of the public.

The Oshkosh plant provides primary treatment which, during the summer months, is supplemented by chemical treatment. We started full operation in August, 1937. Sludge was placed in the digesters and gas generation began sufficiently to operate the gas engines and heat the building in the month of October. Digested sludge was placed on the beds the following spring and summer and was available in the early fall of 1938. No thought was given to the idea of using the sludge as a fertilizer when the plant was built, the only plan then being was use of the material for fill around the plant.

An analysis of the air dried sludge was made to determine its possible value. Of the three important elements necessary in fertilizing materials, it was found that Oshkosh sludge contained the following: Nitrogen 2.2 per cent, Phosphoric Acid 1.5 per cent, and Potash 1 per cent, in addition to its value for its humus content. After looking further into its possibilities, word was passed around that this material was a good fertilizer for lawns and gardens. Without much more than this "whispering campaign," the result was that up to Nov. 1, 1938, income from sludge sales amounted to $156.85. The next year the users of the material noted the results and their remarks and results were noted by others. During 1939 (the second year) sludge sales amounted to $753.00. The same happened in 1940 when sales ran up to $810.00. For these three years, no sludge has been used as fill. In two periods conditioned sludge was not available to all seekers. In other words, we ran short of the product and could not meet the demand.

Marketing Procedure

We gave our newly found income producer the euphoneous name "Oshkonite," derived from the words Oshkosh and Nitrogen. It is sold f.o.b. plant in two forms—*ground* (granulated) and *from the bed* as lump. Persons desiring "Oshkonite" bring their own containers or we can furnish bags at 5c each, allowing a refund if the bags are returned in good condition.

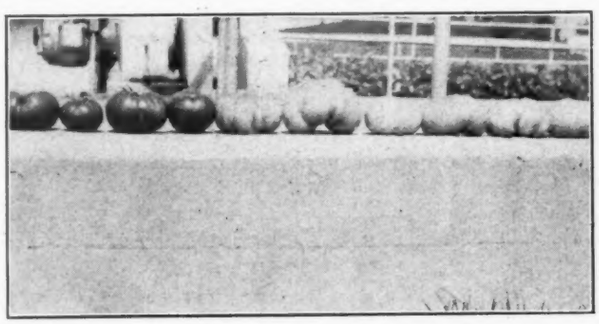


Exhibit "A" at Oshkosh Sewage Plant.
The Yellow Ponderosos Averageing Practically One Pound Each and the Reds Averaging 8 Oz. Each.

Exhibits B, C, and D

Products of "Oshkonite"

Ponderosos Petunias Peppers

The following prices prevail:

Ground		*Bed*	
1 bushel	$ .20	1 bushel	$ .10
2½ bushel bag	.55	2½ bushel bag	.35
6 bushels	1.00	12 bushels	1.00
1 cu. yd.	3.50	1 cu. yd.	1.75

Special prices are made to City Departments and to large purchasers.

[The reason the volume units are used, instead of selling by weight, is that the moisture content varies and no facilities are available for drying other than on the sludge beds.]

Sales slips are made out in triplicate, one copy to the customer, one for the plant and one for our main office.

A hammer mill was purchased and set up for the grinding, using plant power derived from sludge gas. There are 10 sludge beds, 40 ft. by 130 ft., and these are filled during the late fall and winter. During the winter months, the freezing and thawing action in the open beds has a tendency to break up the sludge fibers in such a way that the material does not have to be ground. The frozen product is mealy when it dries out. During the summer drying the sludge is hard and in chunks, thus necessitating grinding in order to make it satisfactory for application on lawns and gardens.

As to the disposition of the returns on the sale of sludge, it has taken care of the purchase of the grinder, paid the wages of an extra man to care for the grounds around the plant and sell the fertilizer, purchased trees and shrubs for landscaping, and provided a balance for other purposes.

Publicity and Demonstrations

Users of the sludge as a soil improver have been the best boosters and advertisers, although it is well to insert an ad in the local paper as to the availability of the fertilizer. As a further means of showing new or prospective users and visitors results from "Oshkonite," a vegetable garden has been planted, and also the various flower beds around the plant, together with trees and shrubs and lawns, are employed as demonstration units. The vegetables as grown have shown a good quality as to texture, size and yield. Particularly impressive was the growth and size of the yellow Ponderosa tomatoes. The largest tomato grown actually weighed 1 lb. 9 oz. The accompanying snapshot shows six of these prize tomatoes, their total weight being 5.85 lbs. The six red tomatoes averaged 8 oz. (½ lb.) each. An accurate check was not made of the yield per vine, since many of the tomatoes were given away to visitors and "prospects" as they ripened. Other vegetables showed similar results. Visitors remarked as to the healthy growth of the stocks and vines and the abundance of the fruit. The flower beds likewise showed the effects of sludge fertility and growth promotion which some believe can be attributed to the growth promoting substances known as hormones or vitamins.

Another example of growth and vitality demonstration was the lawn. A strip of lawn was set aside without fertilization; to another "Oshkonite" was applied. It could be plainly seen where the fertilizer was applied as this patch showed a greater growth and the grass was a rich dark green. A casual remark made by one user was that his only criticism of the fertilizer was that its use necessitated the mowing of his lawn more often.

Sludge Vs. Commercial Fertilizers

Sewage sludge, as far as its chemical plant food content is concerned, cannot compete with commercial fertilizer. Although the chemical content may be low, its humus value is a deciding factor, since it helps to condition the ground in sand and clay soils and also has the power of holding moisture. "Oshkonite" in the granulated form does not burn plants regardless of how much is applied. The test was made by a landscape gardener who planted grass seed in the sludge without adding soil and then kept it watered and placed in his greenhouse. The grass grew and did not turn yellow or burn off.

Values Beyond Plant Food Alone

Some time ago, a physician made a statement in regard to vitamins. The body, he said, can absorb only certain amounts and the unused balance is eliminated with body wastes. This being the case, is it not likely that the much advertised vitamin "B" is present in sewage sludge? There is some peculiar action or a constituent in sewage sludge (at present an unidentified substance) which gives results in plant growth that cannot be explained on the basis of results from a laboratory analysis alone. Only a growth test reveals the hidden values in sewage sludge.

A Conclusion

It is contended by the writer that more stress should be placed on the use of sludge as a soil improver, contributing more vigorous and vitalized growth and a greater yield at this time when conservation and maximum production is the keynote which is to win this economic war. Sewage sludge can be used not only in the gardens around our homes, but on the many "war gardens" and farm lands as well. As an example, one of the local farm owners experimented with the material on a field where he planted oats. When asked how the fertilizer affected the crop, he said, "Swell—its the best oat crop I've ever had."

The nation, in order to produce more food supplies, can use the locally available sludge fertilizer for advancing such production. Sewage works operators can do their bit by popularizing the use of prepared or conditioned sludge in their localities now as never before. In advancing an emergency measure, a sound economic practice can be established for the future as well as the present. And, whatever the return to the sewage works may be financially will constitute an added satisfaction.

WATER AND SEWAGE PATENTS

(of Recent Issue)

Reported by
JULIAN F. SMITH*
Associate Director
HOOKER SCIENTIFIC LIBRARY,
CENTRAL COLLEGE,
FAYETTE, MO.

Water Patents

Removing Silica. O. Liebknecht and L. Gerb (to Permutit Co.). U. S. 2,267,831, Dec. 30. Precipitating silica from water by adding 4 to 10 mg. of aluminum hydroxide and 25 to 50 mg. of ferric hydroxide (each calculated on the metal) for every 10 to 15 mg. of silica per liter of raw water.

Water Purifier. Ray Riley (to Permutit Co.). U. S. 2,267,841, Dec. 30. Demineralizing water in apparatus having a cation exchange unit from which the water passes to an acid removal unit and is recycled to the cation exchange unit until its electrolyte content drops to the specified level.

Water Filter. Jos. P. Lawlor. U. S. 2,268,076, Dec. 30. A water system with two pneumatic pressure tanks, one of which contains a filter in a closed compartment while the other serves as a feed tank in which the water level is held within predetermined limits by a float-controlled valve.

Conditioning Water. Chester T. McGill. U. S. 2,268,607, Jan. 6. A bed of conditioning material in the bottom of a water treatment tank is arranged with the coarsest particles at the bottom and the finest on top; water is supplied to the tank through strainer nozzles at the top and drawn off through a collecting manifold.

Fluoride Removal. O. M. Urbain and Wm. M. Stemen (to Chas. N. Lewis). U. S. 2,268,971, Jan. 6. Removing fluorides from potable waters by contact with an insoluble compound which is charged with free aluminum ions.

Iron Removal. C. H. Nelson, M. Levine and D. F. J. Lynch (to the Secretary of Agriculture of the U. S.). U. S. 2,269,315, Jan. 6. Removing iron and other metals from water by adsorption on lignin, followed by filtration through a sand bed.

Treating Flowing Water. D. Crampton (to Wallace and Tiernan Co., Inc.) U. S. 2,269,393, Jan. 6. In a chlorinator for treating a stream of water the chlorine demand is determined in samples from the stream and the chlorine feed is adjusted accordingly.

Sewage Patents

Purifying Sewage. P.F., A.F. and F. A. Dilles (to Paul F. Dilles). U. S. 2,268,647, Jan. 6. A composition for precipitating impurities from sewage or industrial wastes contains water-soluble alkaline salts together with about 4% of mercurous oxide, 11% of potassium dichromate and 8.5% of zinc oxide.

Floc Concentrator. M. B. Tark (to Link-Belt Co.). U. S. 2,268,726, Jan. 6. A clarifier for liquids has a floc concentration chamber in which a blanket of floc particles is formed, the flocs being withdrawn from the upstream side and allowed to settle.

Reclaiming Tank. Geo. Bell. U. S. 2,270,616, Jan. 20. Separating solids from slurries and sludges in a tank having an inclined bottom and baffles arranged to facilitate settling and collection of the solids.

*Associate Director, Hooker Scientific Library, Central College, Fayette, Mo.

COPPER SULPHATE AS AN AID TO SEWER MAINTENANCE AND SEWAGE TREATMENT

By JOHN W. HOOD
Superintendent
Sewage Treatment Works
RIDGEWOOD, NEW JERSEY

BASED upon our experiences in Ridgewood, N. J., the benefits to be derived from the application of copper sulphate to sewers and house service lines are the following:

1—Odor Control.

2—Reduction in Chlorine Requirements.

3—Better and Less Costly Treatment at the Plant.

4—Root Removal.

Not the least of these is the last item, which, together with the other benefits noted, should interest superintendents of sewerage systems and treatment plants in this powerful and effective copper salt as an aid in sewer maintenance and plant operation.

Odor Control and Reduction of Chlorine Demand

Sulphuretted hydrogen odors, sewerage systems and sewage treatment plants have been so closely associated for so long that they have come to be identified as an inevitable combination. George W. Fuller, in a chapter of his text devoted to desulphurization, writes as follows: "There is no known way of preventing the formation of H_2S, which is released from organic sewage matters by a great variety, and perhaps most kinds of bacteria. . . . In the event that it is true that there are but very few species of bacteria capable of producing hydrogen sulphide through the reduction of the mineral sulphates, it may be feasible to find some way of destroying such growths. It would be better yet to find some means of preventing such growths from becoming seeded in works on account of the importance of guarding against the resulting solvent actions that disintegrate masonry and metal structures. It seems to be a fruitful field for the laboratory man to develop."

These excerpts are typical of the numerous texts which were canvassed.

A remarkable aspect of the H_2S problem at the Ridgewood Sewage Treatment Plant was the heightening of odors during the winter months, when sewage influent temperatures ranged between 34° F. and 40° F.

The Author

Chlorine demands of sewage entering the plant had been variously determined at between 25 and 35 ppm.

A portable chlorinating station was located on the trunk line upstream from the plant and as much as 150 pounds per day, or 16 ppm., based on the flow, were necessary for the control of H_2S odors alone during these winter months.

Thinking in terms of the biochemical aspects of the problem, microscopical examinations of fungi samples taken from various points in the sewer system were made.

A predominance of *Beggiatoa*, a motile filamentous fission fungus, which morphologically resembles the algae oscillaria, was disclosed by these examinations. The ciliated protozoon, *Paramaecium*, was very numerous and active within the parent structure of *Beggiatoa*, moving briskly in all directions. *Uroglena* was also well represented. These three being the major groups, no further examination was made for other types present.

Five out of six references were of the opinion that *Beggiatoa* existed in symbiosis with one or more species of so-called true sulphur bacteria. The sixth reference, "Bergey's Manual of Determinate Bacteriology" (Williams and Wilkins), stated that *Beggiatoa* was capable of reducing sulphates, secreting the amorphous sulphur within their cells, as had been observed in the microscopical examinations. In view of the preponderance of *Beggiatoa* it was felt that the sixth reference was in this case the correct one and that no state of symbiosis existed.

Having failed to dislodge these extensive growths of sulphur bacteria from the system by the application of chlorine, the use of copper sulphate was next considered. On referring to the Nichols Copper Co. publication on the application and uses of copper sulphate, it was noted that five parts per million of $CuSO_4$ were necessary to destroy *Beggiatoa* and work was immediately begun on its application.

Small doses of the chemical (a grade of medium crystal size being employed) were placed in terminal manholes and intermediate intersection manholes, where inspection disclosed that the fungus was growing profusely.

Two barrels of $CuSO_4$ was thus distributed in the system over a period of several days, and upon completion of this work the flushing of sewers was commenced. It was reported that in some lines the pipes were literally filled with the dislodged fungus. As a result of this preliminary treatment and several subsequent treatments of the sewerage system with $CuSO_4$, odors were eliminated to such an extent that up-sewer chlorination was discontinued and pre-chlorination at the plant proper was necessary only during the warmer summer months.

A saving of more than $1,000 per annum for chlorine for odor control at Ridgewood has resulted from the copper sulphate treatment on the sewerage system.

ROOT REMOVAL

Cleaner Sewers and Better and Cheaper Treatment

Chemical coagulation difficulties at the Ridgewood Treatment Works were found to be due to a high pH-alkalinity equilibrium, and this condition was in turn found to be caused by septization and attendant mineralization of the sewage in the sew-

erage system. Close watch on sewer troubles disclosed that they were mostly due to roots entirely clogging the house connections. Visualizing each pipe as being wholly or partially clogged by fibrous root tendons, it was obvious that sewage solids would be retained on the upstream side of the "mat" to decompose, while the filtrate seeped through in course of time. This condition afforded an ample structure within which the ready evolution of anaerobic life and activity, attended by favorable conditions of little or no air, warmth, and fresh organic matter daily could proceed.

A Study of Treatment of House Connections

Several connections whose outlets were available for sampling were selected from a sewer map. They were located in sandy terrain and it was not unexpected that the owners, when approached for permission to experiment, readily granted the desired permission and told of repeated sewer trouble and plumber bills.

The property owner was informed of our intention to use copper sulphate and it was specially emphasized that $CuSO_4$ had no magic qualities; that it merely had a toxic property capable of killing live roots which would in time break loose or disintegrate and be swept out by the flow of sewage. It was also emphasized that these root growths within the pipe were of 10-15-20 year standing; that we had no way in which to ascertain the extent of their infiltration and the amount of copper sulphate which would be necessary to kill them all.

Success crowned these efforts and a comparison of analysis made before and after the copper treatment showed that in all cases the pH-Alkalinity equilibrium had declined. When subsequent determinations disclosed a calcium carbonate equilibrium more nearly resembling the city water, the connection was considered clear and no further treatment given.

Results Noted

A short street of seventeen homes having a bad record of sewer stoppage due to roots was next tackled. After several weeks the determination showed a decline in equilibrium from pH 7.9 and alkalinity of 435 ppm. to pH 7.7 and alkalinity of 227 parts. It is important to state that before the copper treatment of house connections in this street, the sewage was not responsive to any dose of chemical coagulant, whereas afterwards it was found to be amenable to chemical clarifications with much smaller doses than had been previously tried.

When a year had elapsed from the completion of work on this street, each connection was gone over with sewer cleaning equipment. All connections were found clean and clear, no roots being brought out by the equipment.

As a result of these applications of copper sulphate crystals to the sewers in the streets, and a relatively small percentage of the house connections, the influent to the plant has been brought within such limits of the calcium carbonate equilibrium the year around as to be amenable to chemical precipitation at a materially lowered cost.

Some years ago Merle F. Koblish of the General Chemical Co. applied the calcium carbonate equilibrium yardstick to his coagulation problems in Long Island and reported as follows:

1. pH 7.0 and Alkalinity of 100-125. (Very easy and cheap to coagulate.)

2. pH 7.5 and Alkalinity of 125-175. (Increasing difficulty.)

3. pH 7.5 to 8.0 and Alkalinity of 200 ppm. or over. (Difficult to treat.)

This has been the writer's experience also and if copper sulphate can be employed to modify the equilibrium it is obvious that treatment difficulties will diminish. However, this is only true of high equilibrium due to the bio-chemical processes going forward in the root masses. Where industrial wastes are the cause, it would seem that dilution would effect the necessary modification.

Some Practical Pointers Concerning Application of Copper Sulphate

I have been requested by the Editor of WATER WORKS AND SEWERAGE to state definite amounts and procedure for the benefit of readers who wish to tackle their root troubles with copper-sulphate.

Since the extent of the root growth in any given pipe is unknown, a greater or lesser amount of the crystals may be required to permeate the whole mass.

An individual root mass entering at one point may clog a pipe or connection just as effectively as half a dozen, but obviously more crystals would be necessary for the greater quantity of roots.

Property owners and occupants furnish "case histories" by relating their woes with their sanitary connection, and the extent of the root growth may be deduced from their statements.

House Connections

As previously stated, crystals are applied through the commode within the home. The operator carries a cotton bag containing the crystals and puts 2 or 3 pounds through each connection. Where serious trouble and recurrent plumber visits have been experienced by the tenant, initial doses of 6 to 10 pounds have been applied in an attempt to insure complete contact and such cases have been marked down for repeat doses at weekly, fortnightly or monthly intervals, as the conditions seem to dictate. After the initial high dose, and in the absence of any further clogging troubles, normal low doses of crystals may be used.

When a connection is completely plugged and overflowing, rodding must be resorted to to restore flow through the root masses. Thereafter copper sulphate crystals may be applied, but not before. There has to be some flow through the connection in order to carry the solution down through the roots for the attack.

Street Sewer Mains

A light truck and a barrel of copper sulphate crystals are the operator's tools. Junction and terminal manholes are opened, a small scoopful of crystals are sprinkled along the invert of the pipe, and the manhole cover replaced. Thereafter the flow gradually dissolves the crystals and the resulting solution contacts roots and fungi as it flows downstream. About 2 pounds per manhole is applied, but here again this amount is increased as in the case of the house connections, when records indicate serious root trouble.

Under no circumstances should an amount of crystals sufficient to obstruct the flow be placed in the inverts, nor should crystals be placed in the traps of automatic siphon type flush tanks. In the first place, they will not dissolve due to the absence of flowing water, and secondly, they may tend to corrode the metal.

It is recommended that periods of normal to low flow be chosen to introduce the copper sulphate. Both the time of contact and the concentration of the solution are thereby enhanced. A preventative dosage may be given annually following the initial treatment. Old roots do not return, but new root infiltrations may develop.

Records

Careful records of all work should be kept so that not only will the results be disclosed, but eventually all of the system and house connections may be serviced.

Some Important Don'ts

Don't put $CuSO_4$ crystals in fixture traps. Corrosion by interchange of metallic ions will occur and eventually eat holes in the traps. Flush the crystals through the commodes when applying from within homes, and follow with a sufficient amount of flushing water to insure (1) their transit through the soil pipe to beyond the cellar wall and (2) their conveyance to and against the root obstruction, where the crystals will dissolve discharging the solution slowly into the root mass.

Don't expect black magic properties from $CuSO_4$. Remember that a good root mass is well-nigh impervious to concentrated sulphuric acid. Only the life is taken by copper sulphate treatment and thereafter the normal processes of decay must ensue.

Don't waste $CuSO_4$ in the system during periods of high flow. The dilution factor is too great and the resulting concentration of the solution too weak to be effective. Pick low-flow periods.

Don't expect $CuSO_4$ to clean sewers and house connections mechanically obstrubted by breakage, bad connections or faked bends. The amount used on a system in any given time should be arrived at by collaboration with the plant superintendent, who is best able to determine what the traffic will stand, by close observation of the biological and/or chemical processes incorporated in the plant.

Aurora's Instructive Wall Panel

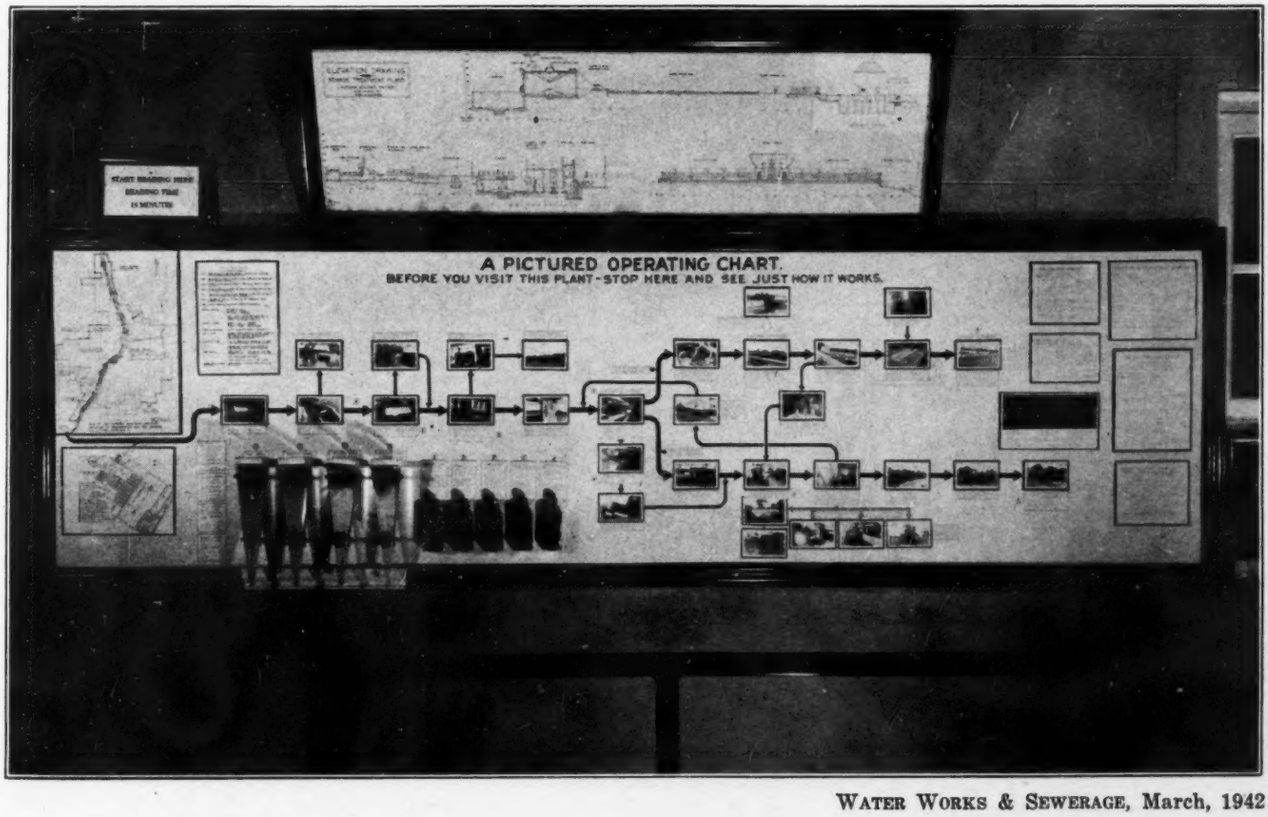
A Picturized Operating Chart with Specimens Attached

At the Aurora Sewage Treatment Plant the plant visitor runs smack into this wall panel designed by Walter A. Sperry, Supt. of the plant.

The sign reads—"Before inspecting the plant stop here long enough to see how it works. But 15 minutes is required to read all captions."

We are reproducing this picture of Aurora's instructive chart because it seems an ideal method of giving the visitor a preview of what he is to see in looking over the works. Further than that, it is used frequently for the purpose of instructing school classes, Boy Scouts and Girl Scouts who visit the plant.

Photographs are used to show the relationships of each plant unit to the other and its functions are indicated by live specimens of crude, settled, filter effluent and final plant discharge in Imhoff Cones. Samples of sludge "before and after" are exhibited and also petri dishes showing what happens to the bacteria. The whole thing is a great idea and, what's more, saves many words.



WASTES FROM THE MANUFACTURE OF PAPER FROM OLD-PAPER STOCK

By E. F. ELDRIDGE
MICHIGAN ENGINEERING EXPERIMENT STATION
EAST LANSING, MICHIGAN

THE use of "old-paper stock" has developed in this country to the point where, for the manufacture of certain grades of paper, it exceeds almost all other sources of pulp. This stock is used in making boxboard, wallboard, roofing, wrapping, printing, and writing papers. Some of the finer grades of paper, such as book and printing paper, and the cheaper grades of writing, drawing, blotting, parchment, catalogue, tissue, etc., are composed of varying amounts of old-paper stock together with pulp from other sources, especially sulphite and Kraft pulp.

In the use of some old stock, rather than all new, there are certain advantages. The fibers are softer and more pliable and are more readily formed into the sheet. However, in working over the old stock there is a certain amount of shortening of the fibers, and, to increase the strength of the sheet, pulp containing longer fibers must often be added.

Conversion of Old Paper Stock

In mills where the color of the final product is of no consequence, mechanical processes are used alone for producing the pulp from the old paper stock. But, in cases where it is necessary to remove ink and coloring matter from the stock a combination of chemical and mechanical processes are employed. Alkalies, such as caustic soda, soda ash, ammonia, or sodium silicate are used to release the ink from the paper. These chemicals react with the adhesive that holds the ink, clay, or other material in the old stock, thus freeing them so that they may be removed by washing.

Figure 1 is a flow diagram showing the several major operations required for converting old-paper stock to pulp which is referred to as "half-stuff." Briefly the process is as follows:

The Author

Papers are sorted by hand into grades, depending upon the desired product. They are dusted, shredded, and placed in cookers, where they are cooked with one or more of the chemicals named. This processing lossens the ink, dye, and other foreign matter. After the stock is removed from the cookers it is washed, bleached, washed a second time, and finally stored in "chests" for use on the paper machines as demanded.

Several types of cookers are in use for de-inking old-paper stock. These are: (1) the open-tank (now seldom used); (2) the cylindrical or globe rotary boiler; (3) the horizontal circulating cooker.

Soda ash is commonly used in making up the cooking liquor. The concentration of this liquor varies from 3 to 10 per cent. The tendency in modern mills is to reduce the quantity of chemical, and a 3 per cent soda-ash solution is now most frequently used. The major portion of the liquor is taken up by the mass of pulp and is later removed in the washer. Most of the carbonate is changed to bicarbonate during the cooking and washing operations. Being of little value, no attempt is made to recover the soda, or to reuse the cooking liquor.

There are several types of washers used for washing cooked pulp. Two types are most commonly used; namely, the "beater" washer and the cylinder or "deckle" washer. The former is a batch washer. The wash water from this machine varies considerably in concentration of foreign matter from the beginning to the end of the period. The cylinder washer employs a continuous process and the wash water is much more uniform in concentration and consistency.

Chlorine, usually as chloride of lime (bleaching powder), is added to the washed stock as it leaves the washer. The mixture is agitated in a bleach-tank and is then washed to remove the bleach liquor. The bleached stock is stored in a tank or "stock chest" until it is needed in the paper mill. It then passes through the usual beaters, the Jordens (machines which condition the pulp), etc., and is held in a "machine chest" until it is to be used on the paper machine.

The purpose of this article is to present data relative to the wastes from the conversion process and methods adapted to the treatment of these wastes. These data were collected during a survey and study made at a number of conversion mills in Michigan in 1941.

Conversion Mill Waste

The major wastes from the conversion process are the spent cooking liquor, washings from deinked

We have been exceptionally fortunate in securing Mr. Eldridge to contribute a series of up-to-the-minute articles on the treatment of industrial wastes.

This is the third of the series by this authority, who has figuratively lived with industrial waste treatment for the past several years.

These articles will be taken from material which the author is working up as chapters for a new book—"Industrial Waste Treatment Practice"—now in the making.

Through courtesy of the McGraw-Hill Book Co., who will publish the new book, Mr. Eldridge is authorized to contribute this valuable series of articles which will constitute a goodly part of the completed book.

stock, and the spent bleach liquor. Table 1 shows the volume and concentration of deink-washer wastes from three mills. The volatile solids test is usually considered a measure of the fiber contained in the suspended material.

The ink-washer wastes are dark gray in color and are highly turbid. The colloidal material which causes this turbidity is very stable and clarification is difficult. Because of the high suspended solids content, the principal treatment of this waste must consist of coagulation and sedimentation. The studies reported below were first conducted on a laboratory scale and later enlarged to pilot-plant scale.

Table 1

CONVERSION MILL WASTES

Mill No.	Volume (gal./day)	Susp. solids (p.p.m.)	Volatile solids (p.p.m.)	B.O.D. (p.p.m.)	pH	Alkalintiy bicarbonate (p.p.m.)
			I—Ink-Washer			
1.....	565,000	1850	1066	163	8.6	528
2.....	608,000	2082	740	190	8.9	...
3.....	1,353,000	2442	421	187	8.3	1076
4.....	928,400	1015	320	155	8.4	448
5.....	810,000	2152	611	285	...	650
			II—Bleach-Washer			
1.....	282,000	774	510	41	...	...
2.....	220,000	664	426	200	7.9	155
3.....	625,000	526	196	30	...	200

Table 2

PLAIN-SEDIMENTATION OF WASHER WASTES
(Series of 11 Runs)

	Suspended Solids			*Fiber*		
	Influent p.p.m.	Effluent p.p.m.	Removal per cent	Influent p.p.m.	Effluent p.p.m.	Removal per cent
Maximum	2492	854	65.8	515	165	68.0
Minimum	2392	2040	14.7	568	454	20.2
Average	2669	1492	43.6	561	273	51.7

Plain Sedimentation Of Washer Wastes

Table 2 shows the results of the operation of a pilot-sedimentation plant employing plain-sedimentation without the use of chemicals. The average removal of suspended solids was 43.6 per cent, and of fiber was 51.7 per cent. The effluent in all cases was very turbid and in appearance was but little different from the raw waste. The removals varied over a wide range. The most effective detention period was 90 minutes.

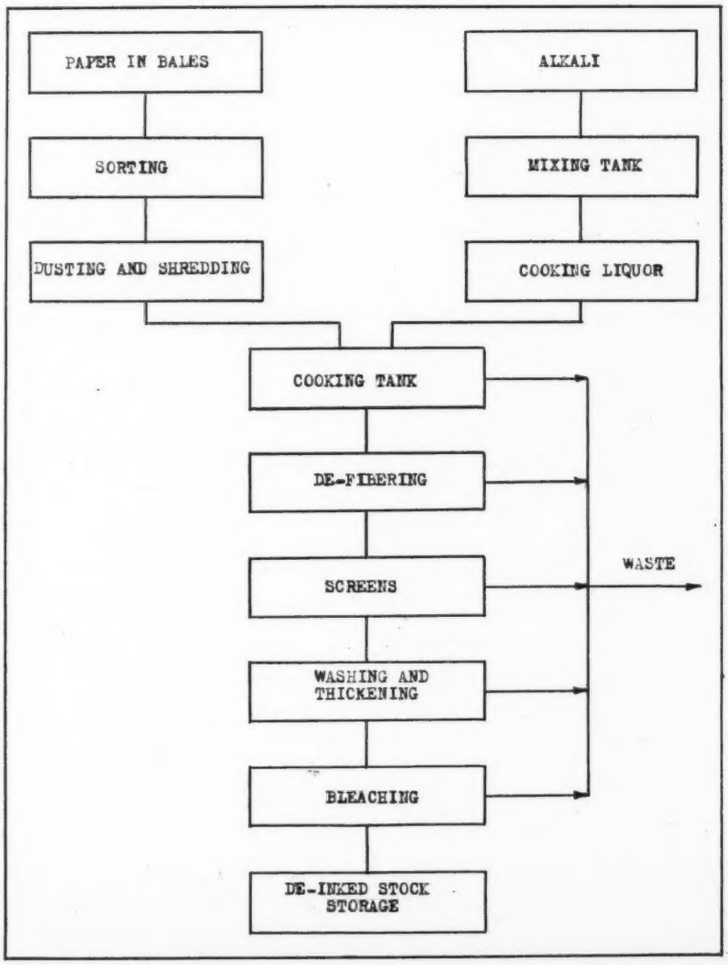


Fig. 1—Flow Diagram of a Conversion Mill for Old-paper Stock.

Coagulation with Chemicals

The following chemicals were used as coagulants for the ink-washer waste: Alum, ferric chloride, ferric sulphate, ferrous sulphate, lime, sulphuric acid, rosin, gelatine, and chlorine. Certain of these chemicals were used in combination. The dosage applied is expressed in terms of pounds of chemical per 1,000 gallons of waste.

Ferrous sulphate, rosin, gelatine, and chlorine did not affect a noticeable clarification of this waste. Sulphuric acid causes clarification, but the amount required is so large as to be impractical. At least ten pounds of commercial sulphuric acid per 1,000 gallons of waste is needed.

Figure 2 shows the effect of lime, alum, ferric chloride, and ferric sulphate on the removal of suspended solids from washer wastes. These data indicate that lime gives the highest removal on the basis of the quantity of chemical applied. Lime also is the least expensive of the four coagulants shown. Alum and ferric chloride give more or less similar results. Ferric sulphate for some reason appeared to stabilize the colloids and was not effective.

Combinations of lime and the three other coagulants were also tried. The data collected in these trials is not given here. It is sufficient to say that the results were but little better than those secured with lime alone. The added cost of the coagulant could not be justified.

The effluent from effective lime treatment is clear and almost free of suspended material, but has a

brown color. The average quantity required for effective coagulation ranges from four to six pounds per 1,000 gallons.

Difficulties Encountered

Lime is usually effective for the coagulation of ink-washer wastes. However, there were times when lime even in amounts up to 20 pounds per 1,000 gallons did not clarify the waste. These conditions were encountered more often with wastes from the batch process than from the continuous washers. It was found that the condition occurred at the beginning of the wash and was most pronounced when the percentage of coated to uncoated papers worked by the mill was high. Further studies showed that the concentration of casein was the influencing factor. Casein is used in coating papers, and when adding casein to an otherwise easily coagulated waste a condition was produced whereby coagulation could not be affected even by large amounts of lime. The results indicated that the condition became most pronounced when the concentration of casein reached three to four pounds per 1,000 gallons. The only method by which clarification could be accomplished when this condition existed was by dilution of the waste with bleach washer water or the so-called "white-water" from the paper machine.

The dilution and lime dosage necessary to reduce the suspended solids by more than 90 per cent, and to clarify the waste, varied with the concentration of casein in the waste. Figure 3 shows the dilution and the quantity of lime required for a typical waste in which this condition existed. From a large number of tests using wastes from four different mills, it was finally determined that in order to be able to coagulate ink-washer wastes under all conditions provision must be made for at least a 1 to 1 mixture of white-water or bleach washings and ink-washer wastes. From this statement it appears that such an arrangement will double the required capacity of a plant for the clarification of this waste. However, this is not necessarily the case, since both bleach-washer waste and a certain portion of the white-water from this class of paper mills will also require treatment for the removal of suspended solids.

Capacity of Structures Required

The structures required for the coagulation and sedimentation of this paper-mill waste are: (1) mixing

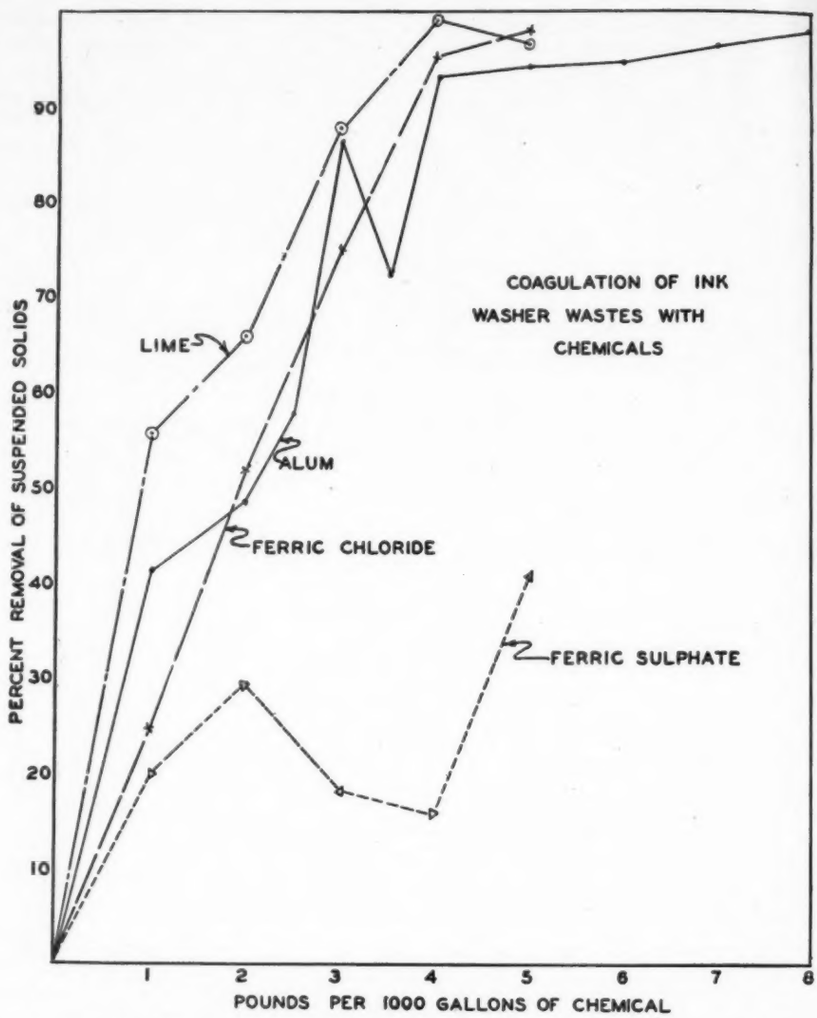


Fig. 2—The Effect of Several Chemicals on the Coagulation and Sedimentation of Ink-washer Wastes.

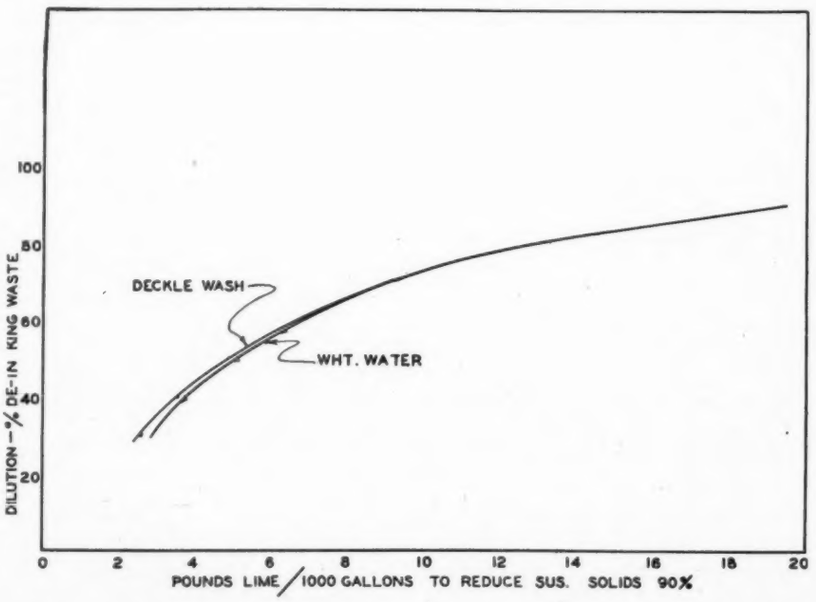


Fig. 3—Dilution and Lime Requirements for Effective Coagulation of Ink-washer Waste.

trough or tank; (2) lime feed machine; (3) coagulation tank; (4) settling tank; and (5) vacuum filter.

A trough or flash-mixer may be used for mixing the lime with the waste. A detention period of about 30 to 40 seconds is sufficient. The lime may be applied in either the dry form or as milk of lime. The capacity of the lime machine should be sufficient to apply a maximum of six pounds per 1,000 gallons of waste to be treated.

Following the rapid mix, the coagulation and settling periods should be 20 minutes and 90 minutes, respectively.

The sludge for the process amounts in volume to 3 to 4 per cent of the volume of waste treated. This sludge is light gray in color and contains from 4 to 6 per cent solids. It filters fairly well on the vacuum filter without preconditioning. The sludge cake contains from 55 to 60 per cent water. The rate of filtration varies from 1.5 to 2.0 pounds of dry solids per square foot of filter area per hour.

Summary

(1) Ink-washer wastes from the conversion of old-paper stock is highly turbid and difficult to clarify.

(2) An average suspended solids removal of about 44 per cent was obtained by plain-sedimentation for a 90 minute period.

(3) Lime was found to be the most effective coagulant for the waste.

(4) A high concentration of casein resulting from the working of coated papers interfered with coagulation.

(5) Ink-washer waste diluted in proportions of about 1 to 1 with bleach-washer waste or white-water was effectively coagulated with lime under all conditions.

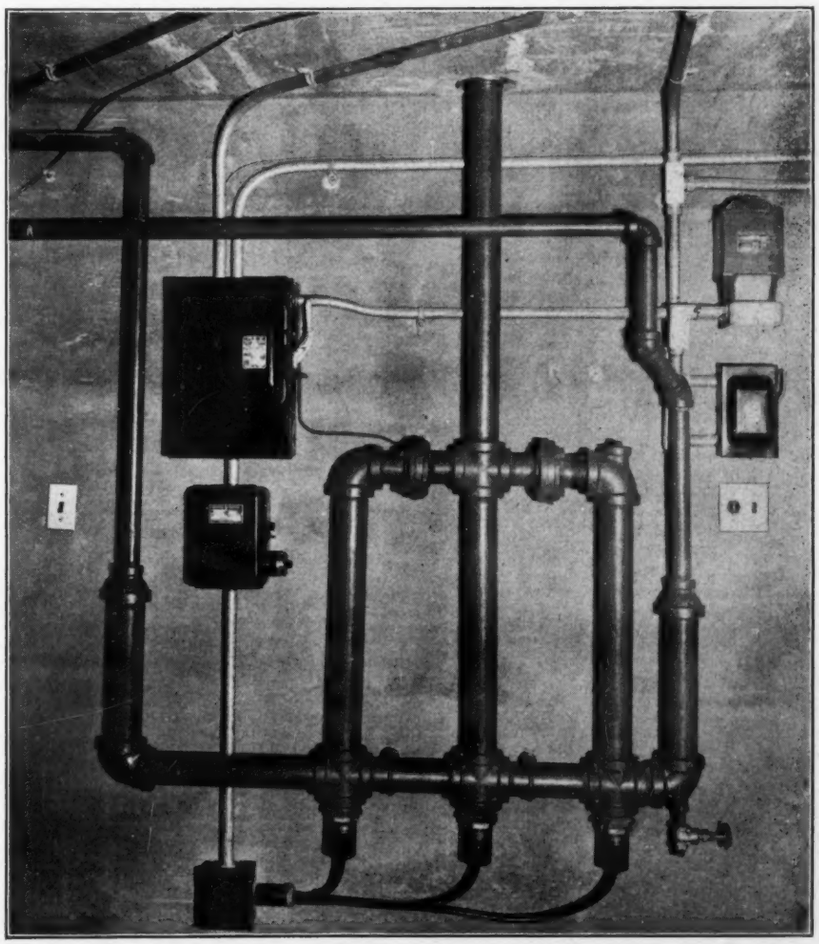
Electric Heat Solves Problem at Pumping Station

Electric heat proved the answer to a heating problem recently presented at the plant of the South Bay Consolidated Water Co. at Bayport, Long Island. This pumping station contains two rooms on the ground floor, and a basement. One of the two ground floor rooms serves as an office, and the other is the chemical feeder room, separated from the first by a brick partition.

Since the chemicals stored in this second room are of a nature to attack almost any metal except cast iron, it was decided that the best method of heating the room would be by using cast-iron radiators. It was decided to build an immersion heater "electric furnace" in the basement to supply hot water to the radiators in both first floor rooms.

Three G-E electric water immersion heaters are used to heat the water in this ingenious furnace. The hot water riser leads from the top of the three heater-enclosing pipes to the radiators on the main floor. The returns lead back to the bottom of the furnace, providing a neat, compact circulating system. An expansion tank is connected to each of the radiators in the first floor rooms. The radiator capacity is so arranged that the expansion tank can take care of the water expansion under any operating condition.

A magnetic contactor handles the heater load, and is controlled by a thermostat located in the operating room above.



Pump Station Heating System, Including Use of Three Electric Immersion Heaters

"WATER PURIFICATION FOR PLANT OPERATORS"

Authors—GEORGE D. NORCOM and KENNETH W. BROWN

Publisher—McGraw-Hill Book Co., New York City
Price—$2.50

Reviewed by JOHN R. BAYLIS*
Associate Editor

THIS small book handles well a subject which cannot be handled satisfactorily in a small book. The authors, from operating experience, are well qualified to give advice on water purification practice. This they have done in a creditable manner. There are such a variety of conditions encountered in the various water purification plants in the United States it is impossible to set rules of operating practice covering all of the things to be done in a small volume. The authors have done well, however, in the selection of their material.

The preface indicates that the authors had in mind the small water purification plant with only one operator on each shift. It also indicates that they expect these operators to have little or no technical training. The questions at the end of each chapter indicate that the book is intended for the student of water purification.

The operator, of course, should have been a student of water purification before he became an operator. Unfortunately this has not always been the practice heretofore in the selection of water purification plant operators. The book likely will be of greatest help to untrained operators already working in water purification plants. However, it contains much good advice to the experienced operator, particularly in the matter of plant records.

A few comments in the nature of criticism will be made. The illustrations are few, and in some instances none too appropriate. The student will have difficulty in following the text without appropriate illustrations. The plant operator also may become confused when the description is directed to apparatus different from that in his plant. The student will have to go to some other publication to obtain an idea of what a filtration plant looks like on the inside, to find the location of the underdrains and the wash water troughs of a filter, as well as to understand much of the other parts of the plant referred to in the book.

These comments suggest the probability that more would have been accomplished by confining the book entirely to operating practice, and assume the reader understands the design of the various parts of such plants.

Operating experience leads to different views as how best to accomplish efficient operation. Many likely will disagree with the authors in some of their statements, and in some of the advice given. The book is their interpretation of how best to operate water purification plants.

In the coagulation test given on page 32, the most valuable part of the test is omitted. That is the determination of the clarity of the water after filtration.

There is recommendation on page 46 that the turbidity of the water be reduced to less than 1.0 in the filter effluent. If the authors intend that the reduction be to about 0.2 to 0.3 under normal operation, the advice is good; but if they believe that water having a turbidity of 0.9 is satisfactory, this differs from the belief of many.

The recommendation to close the wash water valve slowly is good advice. However, there is doubt that the old idea that it produces better stratification of the sand bed, according to size of the sand grains, is fact. In any event, closing the valve slowly compacts the bed more closely and lessens the size of the openings through the bed. Also it tends to lessen the shrinkage of the bed when in operation.

On page 55 there is reference to air producing violent agitation of the sand when it is used in connection with washing filters. Do we have evidence that there is movement of the sand by the air? Why should sudden changes in the rate of filtration, as stated on page 57, cause air binding by the release of dissolved oxygen?

Chapter VII on filter troubles is a little confusing in places, but in general it treats the subject very well. The chapter on water softening is more a brief description of softening than the operation of softening plants. However, such operating advice as is given is good.

Chapter X on chlorination is believed to be the most important chapter in the book. The instructions to operators, and advice on the control of chlorination and the safe handling of chlorine are good. In the use of gas masks, caution should have been given that the concentration of chlorine gas in a room not properly ventilated may become too great for a mask to be effective.

The chapter on operating records, giving report forms used by the Federal Water Service Co. is good. If the report forms had been filled in with figures, this would have been helpful to those unfamiliar with such forms.

The chapter on laboratory control probably deserves the greatest criticism. When the authors state that technical training is not essential for water purification plant operators, many will disagree. Whether the employee is trained in college, or is trained in a water purification plant, technical training is essential. Not only is it essential for the safe operation of a water purification plant, but is believed essential to understand this book. Reading this chapter, the impression may be gained that most any one out of high school could purchase a copy of "Standard Methods of Water Analysis" and be regarded as capable of conducting the necessary tests on water in a water treatment plant laboratory.

These few critical remarks should not detract from the book as a whole. The authors have given a great deal of helpful information, and the book will be welcomed by many.

*Physical Chemist, Dept. of Public Works, Chicago.

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It is impossible to foretell future requirements or population shifts in metropolitan cities but any public official can be sure that, when water or sewer mains must be abandoned or re-routed, the pipe can be salvaged or re-used, *if it is cast iron pipe.*

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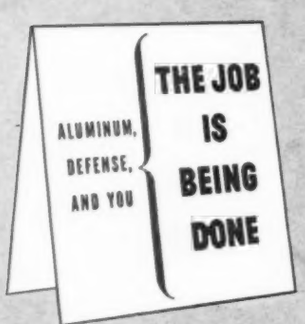


ALCOA ALUMINUM

EFFECT OF BREAK-POINT CHLORINATION ON FILTER RUNS AND ALGAE GROWTHS

Some Experiences at Fredericksburg, Va.

By ALBERT E. WILSON, JR.
Superintendent of Filtration
FREDERICKSBURG, VA.

THE Rappahannock River serves as the source of water supply for Fredericksburg. The water flows from a power canal, paralleling the river, into a ten million gallon pre-settling basin having a detention period of from three to four days. Low lift pumps deliver the water to four coagulation basins run in parallel. Alum is fed ahead of the pumps which provide a flash mix. Chlorine is added after the pumps. The dosed water then passes through four slow mixing tanks, equipped with four Link-Belt mixers, one for each basin. There is one influent and two intermediate baffles in each tank. The plant has a design capacity of 6 mgd., but the daily rate at the present time is from 4 to 5 mgd. At this rate the detention period in the mixing chambers is about thirty minutes and in the basins three and one-half hours. This is ample time for the break-point chlorination reaction to go to completion according to Griffin.[1]

The water is collected in a flume and flows by gravity to four half-million gallon filters and four others with a million gallon capacity each.

Chlorination Experiences of 1941

The writer took over the operation of the plant in April, 1941. At that time the prechlorine dosage was 0.67 ppm. There was a residual of 0.2 ppm. chlorine on top of the filters. With the coming of warmer weather this residual gradually decreased to a low of 0.13 ppm. in June. The average alum dosage was 140 PMG. (PMG = Lbs. per million gallons.) The raw water analysis is as follows:

Alkalinity	25
CO_2	3
pH	7.2
Threshold odor	25
Turbidity	10 to 300

The filter service hours averaged 67 for the first three months, this representing an increase of 11.5% over the 1940 average of 61 hours. The turbidity of the raw water was 25 for this period. About the middle of April a long dry spell set in and continued through June. The

The Author

turbidity fell below 10 ppm., and conditions were ideal for abundant algae growths. The dominant genera were Synedra and Asterionella, the former clogging up the filters greatly. Filter runs decreased 15% during April, May and June, averaging 57 hours. Copper sulfate treatment was begun in the latter part of April, being fed into the raw water basin daily. The raw water chlorine was increased to 9 PMG. (1.08 ppm).

"Break-Point" Chlorination Tried

This was the full capacity of the chlorinator at that time. No beneficial results were forthcoming. It was decided to increase the capacity of the chlorinator to possibly feed enough chlorine to reach the "break-point." This might put an end to our algae troubles and increase the filter runs. Then, too, the sand beds would be kept sterile and free of organic deposits. No thought was given to taste and odor removal as this has not been a problem, up to the present time at least.

Break-point chlorination tests were run in the laboratory to determine if there was a break-point and how much chlorine would be required. It was found that there was a slight "break" at a surprisingly low dosage of only 1.6 ppm. This figure has been fairly constant, but at this writing the break-point dosage has dropped to 1.2 ppm. The break-point treatment was begun in the plant on July 10, 1941. Two parts per million chlorine were fed which brought a residual of 0.4 ppm. onto the filters.

Turbidity Did Not Interfere

High raw water turbidities do not affect the break-point chlorine dosage. The turbidity was well over 100 during July and August. It was thought that the mud would absorb enough of the chlorine to seriously interfere with the break-point reaction, but such was not the case.

The average pH of the settled water has been 6.3 and has reached a minimum of 5.8 at times. This is somewhat low for optimum oxidation to take place according to Griffin,[1] who reports that the reaction works fastest at a pH of 6.5. As the pH value rises above or falls below 6.5 the longer the time required for the break-point reaction to go to completion.

Filter Runs Show First Effects

The most noticeable result during July was a sharp rise in the length of filter runs, which continued throughout August. The filter runs have not been as long for the past four months due primarily, I think, to the fact that the raw water has been unusually clear. The floc formation has been poor on many days, despite the fact that various alum dosages were fed after a trial with the laboratory stirring machine. However, the algal growths have been completely destroyed by oxidation. No organisms have been found in the wash water during a filter washing as had been the case previous to adopting break-point chlorination.

The average filter runs for the year 1940 and the first six months of 1941 are shown in Table 1. And Table 2 shows the monthly averages for the last six months, since beginning break-point chlorination. It is noted that an increase of 40% in filter runs has been accomplished. The percentage wash water for the first and last half of the year is shown in Table 3. The reduction in wash water has been 28.4%, representing a substantial saving.

The residual chlorine in the filtered water has risen from a trace to

0.4 ppm. in the effluent from the new million gallon units up to November 17, 1941. The effluent from the fourteen year old half-million gallon filters did not show a residual over 0.05 ppm. up to that date. These filters were in use for twelve years without the benefits of prechlorination until the plant was enlarged in 1939. They had thus collected a rather heavy amount of organic matter. However, it is hoped that during the winter months the filter sand will be freed of organic deposits by carrying a fairly high chlorine residual in the settled water. With this end in view, the chlorine dosage was stepped up to 1.8 ppm. on November 17. This is giving a residual at the present time of 0.6 to 0.65 ppm. in the settled water and 0.5 ppm. in the effluent from the new filters. The residual in the effluent from the old filters has gradually risen to 0.25 ppm. (December 12, 1941), showing a progressive oxidation of organic matter in the filter bed.

As a direct result of ever increasing chlorine residuals in the filtered water the final chlorine dose has been steadily reduced from 0.28 ppm. until it was cut out entirely on November 18. The residual in the plant effluent varies from 0.25 to 0.3 ppm. This compensates to some extent for the increased consumption of chlorine in the raw water.*

*Note: On December 9, 1941, chlorination of the finished water was again begun as a defense measure, now that we have declared war. The final residual has been increased to provide 0.35 to 0.40 ppm. in the finished water.

TABLE 1

FILTER RUNS BEFORE BREAK-POINT CHLORINATION

Filter Number	1	2	3	4	5	6	7	8
Average hours, year 1940	53	58.5	58.5	59.5	75.2	73.2	61.6	51
January	52.3	59.6	69.2	76.3	83.6	78.5	71.8	59.5
February	54.8	57.5	65.7	73.6	79.8	79.4	69.3	58
March	55.4	58.1	70.3	68.8	67	71.6	58.7	52.4
April	57.4	55.3	57.7	63.4	65	66	57.7	48.9
May	53.7	51.9	52	50.2	52	53.4	49.3	37.2
June	65.6	61.3	60	56	72.7	71.4	60	45.4
Average for all filters, 1940 and first six months 1941								61.5

TABLE 2

FILTER RUNS DURING BREAK-POINT CHLORINATION

Filter Number	1	2	3	4	5	6	7	8
July	108.2	100	104	102	122	118	105.4	83.5
August	100.2	89.3	90.4	88	114	114.6	93.5	71.2
September	72.4	67.5	67.5	67	81	85	67.8	58
October	65.4	68	66.1	71.7	87.5	75.2	73.6	55.5
November	66	73.3	76.7	82.4	91.4	87.2	80.4	66
December	77	80.6	84.6	86	97.5	92	87	76.4
Average for all filters								85.6
Increase in length of filter runs								40%

TABLE 3

PER CENT WASH WATER FOR YEAR 1941

	Per Cent
January	2.23
February	2.15
March	2.20
April	3.20
May	2.65
June	2.37
July	1.63
August	1.80
September	2.28
October	1.80
November	1.60
December	1.50
Per cent reduction since Break-Point chlorination was begun July 10, 1941	28.4

There has been a decrease of 13% in the alum dosage since the month of June.

These results of break-point chlorination cover a rather short period of plant operation, but it is hoped that the benefits derived from break-point chlorination will continue in the future. Another article dealing with the effect of break-point chlorination on the coli-form group of bacteria will follow in a month or so.

Reference

(1) "Super Chlorination"—A. E. Griffin, Asst. Manager, Technical Service Division, Wallace & Tiernan Co. A paper read before the Virginia Section, A.W.W.A., at Roanoke, Va., on October 30, 1941.

Court Upholds State Orders to Provide Sewage Treatment

An order was issued by the Wisconsin State Health Department and the State Water Pollution Committee, jointly, on a Wisconsin municipality which called for provision of more complete treatment of sewage than was at the time being given by the then existing plant.

The municipality fought the order —contending it arbitrary, and in excess of powers of the Board of Health and Committee on Water Pollution and, therefore, unconstitutional. The city contended the existing sewage treatment facilities to be adequate. Further, it was contended by the city that for the statute under which the Board is empowered to be valid, it must prescribe that *actual* damage or menace to health or comfort exists at the time.

In reply to these contentions of the city the State Supreme Court had the following to say:

"In the field of public health such a contention is utterly ridiculous. If counsel is correct, the State Board of Health and State Committee on Water Pollution would be powerless to act in a case of stream pollution until at least a few deaths by typhoid had occurred so as to make the nuisance or menace to health an 'actual' one. This would be the result if the Board had to act on fact rather than on a tendency.

"All public health work is predicated on preventing a health hazard rather than waiting for an epidemic to occur, or even to wait until the public is subjected to hazards that can be anticipated from experience or occurrences elsewhere. The policy of 'locking the barn after the horse is stolen' may be all right in some fields, but it would be nothing short of criminal in the field of public health."

This decision is indeed an interesting and an important one.

Milwaukee's Practical Test for Sewer Inspectors

A "tunnel crawling test" was recently given candidates for the position of sewer inspector in Milwaukee. Each of the 100 applicants was required to descend 16 feet into the city sewer system and crawl through it for a distance of 327 feet. Milwaukee has made frequent use of similar practical methods of testing applicants for various jobs. The tests are conducted by the Civil Service Commission of Milwaukee as part of the regular examination procedure.

Deep Stuff

Margaret: "Do you know Art?"

Clarence: "Art who?"

Margaret: "Artesian."

Clarence: "Sure. I know Artesian well."

N.E.W.W.A. WATER WORKS SCHOOL AND FEBRUARY MEETING

Demonstrations in Hydraulics Laboratories of M.I.T. the Forenoon Feature, with Afternoon Devoted to Defense Topics

By HARRY A. FABER*
Associate Editor

A FULL program was provided for the meeting, on February 19th, of the New England Water Works Association in Boston. Three divisions which usually hold separate sessions—the Water Works School, the Superintendent's Round Table, and the Chemist's Round Table—met in a joint session at the Massachusetts Institute of Technology, in Cambridge, during the morning, for a laboratory demonstration of hydraulic principles. With the exceptional facilities and equipment provided at the Institute, this feature proved worthy of being repeated at subsequent meetings by popular request.

Professor George E. Russell, ably assisted by Professors A. T. Gifford and F. O. Rose of the Institute faculty, supplied a graphic demonstration of such fundamental considerations as orificial flow, hydraulic head losses in pipe lines and through valves and fittings, and the principles of the centrifugal pump. The application of proper formulas to practical calculations was related to each principle demonstrated. Use of models in the design of spillways and the hydraulic jump to absorb velocity head was exhibited in an impressive manner. This session proved so informative and interesting that Professor Russell's "Class" adjourned with some reluctance. The luncheon and technical meeting were held in the Hotel Statler, Boston.

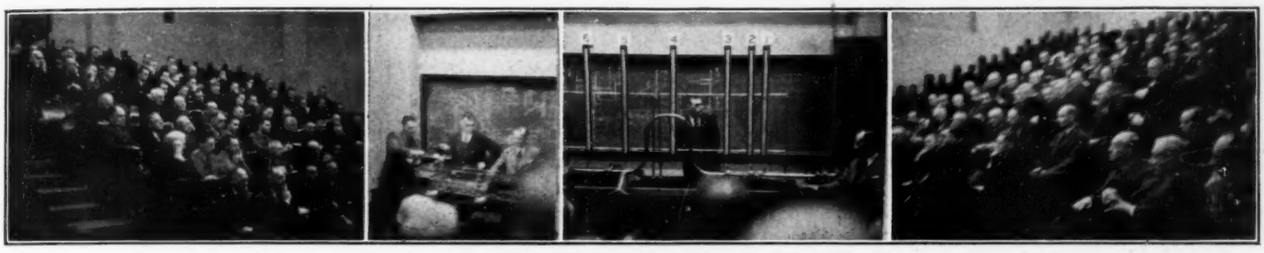
*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

The Afternoon Session

President Francis H. Kingsbury presided at a brief business meeting which was devoted to consideration of the "Tentative Specifications for Sluice Gates" as approved by the A.W.W.A. and printed in the Journal. While it was recognized these specifications are incomplete because tests are lacking, it was pointed out that they are acceptable to manufacturers. They were, after some discussion, adopted as tentative specifications by unanimous vote of members.

The technical program included a sound motion picture titled "Warning," which depicted preparations in England for air raid attacks. Activities of the organized civilian defense corps were shown in detail, both before and during air raids. Apparently filmed under severe difficulties, this motion picture illustrated the effect of bombs and practical defense measures in a most impressive manner.

"Our Present Obligations" was the title of a timely message delivered by Mr. Joel W. Eastman. Mr. Eastman, a Boston attorney and a former Chautauqua speaker, presented his philosophy advocating present sacrifices as an investment toward an ultimately better world. He amusingly described his background as an experienced water works man who had almost alone built the first (and existing) water system in Providence, Kentucky. As a lawyer he had obtained the franchise and sold the necessary bonds, then as a practical man he had laid out the system—which, for lack of an engineer and transit, was graded with a carpenter's level! Times have changed, he pointed out, but such pioneer spirit and determination may again prove necessary for the trying days to come.



The Water Works School at M. I. T.

(1) The class—superintendents, consulting engineers, chemists. (2) Professor Russell, assisted by Professors Gifford and Rose, demonstrating a spillway model and the hydraulic jump. (3) Professor Russell (with pointer) and Professor Gifford (behind the model) demonstrate friction losses through meter, bend, valves and fittings. (4) Another shot of Professor Russell's class, few of which got as good instructions in their day at school.

Emergency Plans for Fire Service

"Coordinating the Fire Service," by Percy C. Charnock, State Fire Coordinator for Massachusetts.

Mr. Charnock described the helpful relationship which has always existed between communities which need extra fire fighting equipment in local emergencies and neighboring communities. The problem today, however, is to plan an orderly movement of equipment during a widespread emergency and to still maintain local integrity. Establishment of mutual agreements is necessary so that no community will be without equipment when a heavy concentration is required in one locality.

This plan has been developed in Massachusetts by first taking stock of what types of apparatus are available and by keeping this record up to date. The Office of Civilian Defense has sent questionnaires to determine types, capacity, and age

of equipment. The location of such apparatus is now designated on maps of the state, with a suitable key to indicate that which can be transferred when need arises. In the vicinity of Boston, nine contiguous areas have interconnected fire alarm systems with facilities for using telephone services over these same lines. According to an automatic plan, these communities will send equipment — but only when fires reach five alarm proportions, and then to replace equipment drawn from Boston stations.

Some 1700 trained auxiliary fire fighters and 800 partially trained men are now available. This has been done under municipal plans as no Federal aid has yet been forthcoming. According to 1941 tabulations, more than 40% of pumpers in service are obsolete and in need of replacement. By now, the situation is even more serious and, in Mr. Charnock's opinion, Federal refusal to supply funds for new equipment is false economy.

Municipal orders placed several months ago for equipment have not been filled since they lack the necessary priorities. Under a plan now proposed, fire fighting equipment will be provided on a loan basis by the O.C.D. for critical defense areas. If such funds do become available, it is estimated that 700 pumpers will be needed for the state of Massachusetts alone.

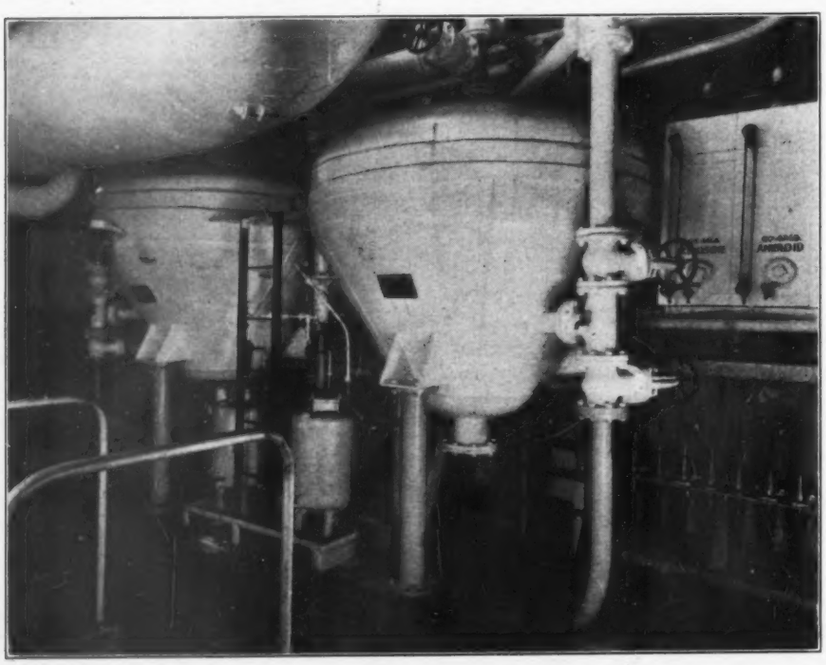
(1) In MIT's general hydraulics lab. (2) Professor Russell at work developing principles of the centrifugal pump and controlling factors. (3) Demonstrating the sharp-edged orifice with its impressive glass-like quiet parabolic jet—not a splash, not a sputter. (4) Between times the camera caught Professor Franklin Rose, exchange professor of hydraulics from Univ. of Southern California, checking up on Professor Russell.

Removal of Oil From Condensates

CONDENSED exhaust from reciprocating engines and steam pumps is frequently wasted because the otherwise useful condensate contains oil or grease. If oily condensate is used for boiler make-up it is frequently the cause of serious operating troubles, the more common of these being (1) Foaming and priming, (2) Corrosion, (3) Overheating of boiler tubes

Oil may be removed from condensates by filtration. However, oil that exists in emulsion or a fine state of division must be coagulated prior to removal by filtration, and for this aluminum sulphate and caustic soda are used. Before entering the filters the condensate is given a treatment of approximately one grain of aluminum sulphate and ½ grain of caustic soda per gallon. The resultant aluminum hydrate precipitate forms a flock which coagulates the finely divided oil particles, thus holding the oil on the surface of the filter bed.

The operation of the filter is very simple. The contaminated water enters the filter at the top and leaves from the lower connection. The entering water passes through the adjustable orifice, which causes sufficient resistance to shunt a small proportional amount of water through the coagulant tank, wherein it becomes saturated with alum and delivers the coagulant to the filter side of the orifice at a rate proportional to the rate of flow through the adjustable orifice. When using sufficient coagulant, the filter bed retains the suspended matter at its surface and permits only a crystal clear water to pass through. When the pressure loss through the filter bed becomes excessive, the filter is cut out of service and back-washed.



An Oil Removal Filter*
** Photo by Courtesy of Cochrane Corporation.*

Simple Test for Oil

A helpful preliminary test for the presence of oil in boiler feedwater can be conducted by anyone. Just take an ordinary clean test tube, fill it to a depth of about two inches with the feedwater to be tested, and shake it in your hand for a few minutes with your thumb over the test-tube opening. If at the end of a short period of shaking, oil globules appear on the surface of the water you can be positive that there is oil in the feedwater. If at the end of the shaking period there is no evidence of globules at all, you can be fairly sure that the amount of oil in the feedwater is insignificant.

MODERN ADAPTATION OF ARCHITECTURAL CONCRETE

Attractive Structures Result at Minimum Costs

ORDERS from the Supply Priorities and Allocations Board have stated that construction requiring critical defense materials be limited to projects either directly necessary for the national defense or essential to the health and safety. Therefore, for the following reasons these orders should not disturb construction of water works, sewerage systems and treatment plants other than to a limited extent.

First, these interdependent utilities are of such a nature that they are essential to the health and safety of the people, which classifies them as priority projects.

Second, water and sewage works can for the most part be built of reinforced concrete, which uses the minimum of critical materials.

According to the magazine "Steel," shipments of structural shapes and reinforcing bars for the past four years (to December 1, 1941) have been approximately 15,000,000 tons, 27 per cent of which tonnage was represented by reinforcing bars. Not all this tonnage goes into building construction, however.

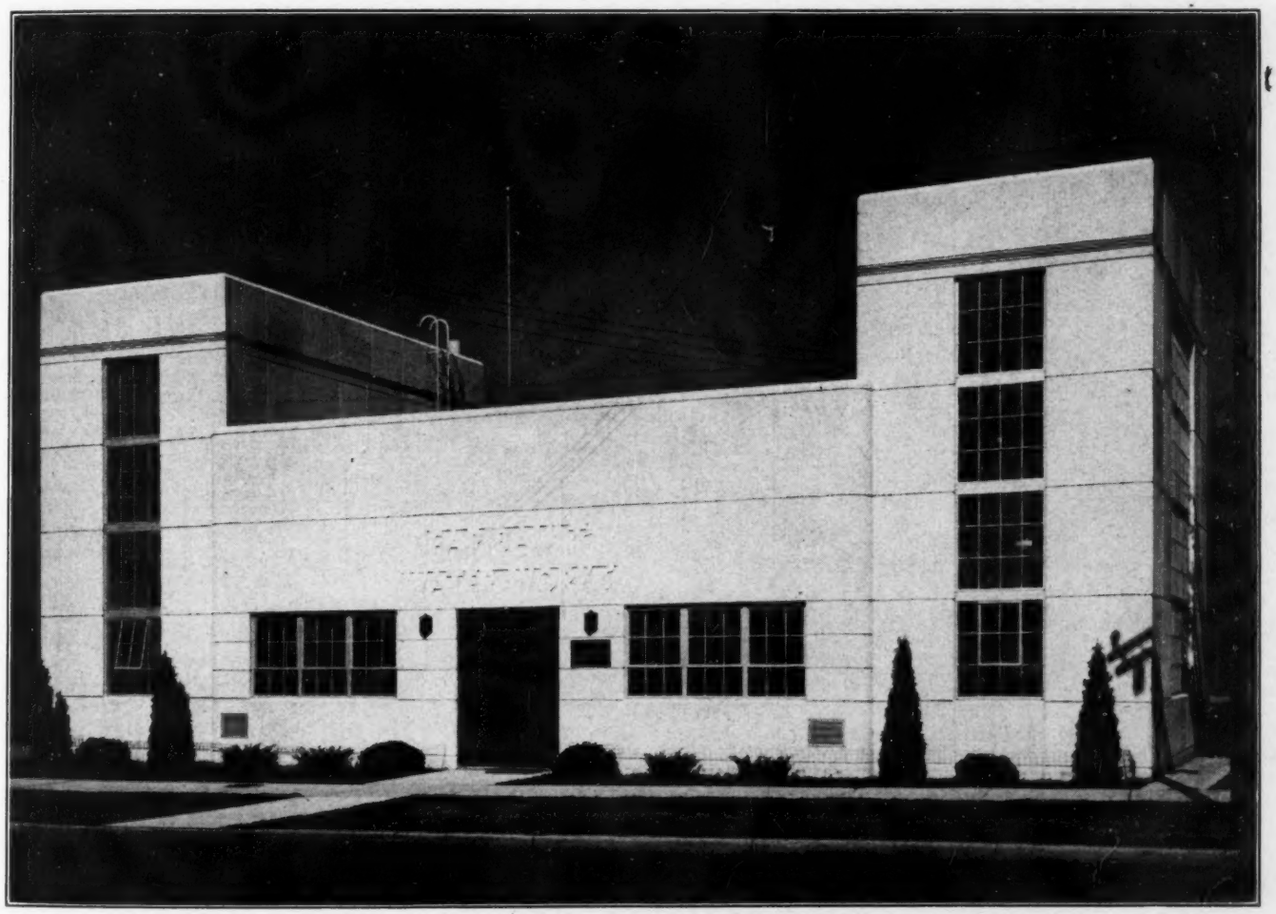
Analysis of building frames shows that, on the average, three times as much steel is used in building a structural steel frame as is used in a reinforced concrete frame having equal load-carrying capacity.

Projects designed in reinforced concrete, therefore, take little or no tonnage of steel from direct defense construction.

The Place of Architectural Concrete

Inasmuch as reinforced concrete frames require enclosing walls it is logical, in many instances, to go an additional step and build all structural and architectural elements as a unit. This is readily done in architectural concrete since external architectural treatment can be produced integrally with and at the same time the structural elements are built.

During the past few years scores of architectural concrete water and sewage works buildings have been



The Water Filtration Plant of Faribault, Minn.
The Towers Are in Reality Functional While Producing an Attractive Elevation as an Incidental Attainment.

constructed throughout the United States. Some of these, both large and small, were built in latitudes where extremes of temperature range between 25 degrees below zero to more than 100 degrees above. The experiences of 1941 have more than ever demonstrated that architectural concrete is a satisfactory material for a wide range in climate.

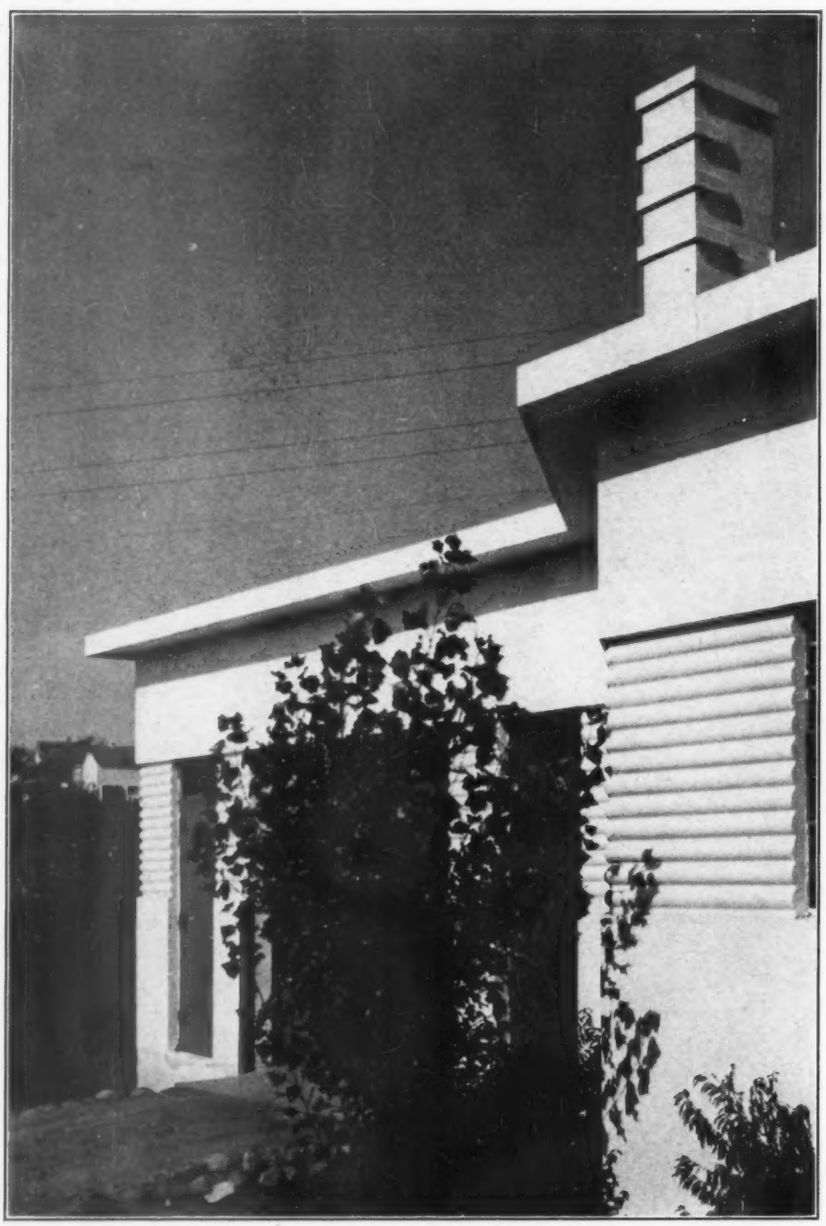
Architectural concrete has been selected as the construction material for manifold reasons. Some of these are: its adaptability to all styles and forms of architectural treatment; its low maintenance cost; its durability; and its reasonable first cost. It has also been found well adapted to work-relief programs where a maximum amount of hand labor is desired.

A Representative Application

As indicated by the accompanying photographs, architectural form and detail of great variety is possible through the employment of architectural concrete. Space does not permit describing details of each of the buildings pictured, but as construction technique generally follows the same pattern, regardless of the design, description of a one project may be taken as more or less typical. The project selected is the waterworks at Faribault, Minnesota.

Erected in front of an old building used for pumping and storage, the new waterworks structure is 32x67 ft., with the end sections rising to a height of 36 ft. These high ends were no aesthetic inspiration. They are strictly essential to the operation of the plant. Before the building was started, two wells were drilled and one pump and all necessary piping were installed. The functional arrangement of this equipment determined the design of the building, for the wells center under the high sections of the building, the height permitting withdrawal of well casings through scuttles in the roof over the pumps.

The high space was not required for any other equipment, and for this reason the center portion of the structure is lower. The result is minimum cubage and minimum total cost, while securing an interesting elevation.



Bands of Reeding Effectively Used on the Water Plant of Fergus Falls, Minn.

An Unusual Exterior

A most effective feature of the building is the texture of exterior walls. This was achieved by dividing the forms into squares, using horizontal and vertical form boards in alternate panels. The panels are separated by narrow rustications secured by nailing molding strips to the inside of the exterior forms. This simple method of forming produces a constantly changing play of light and shadow, depending upon the slant of the sun. (Also, a most pleasing but simple detail is the bands of reeding in the walls of the plant of Fergus Falls, Minn.)

Exterior walls were finished with two coats of white portland cement paint. Interior walls have a tile wainscot 7 ft. high, with the plastered walls above painted. All doors and window frames are of metal. There is no chimney, no fuel, ash or boiler room and no radiator or piping on floors or walls. Three automatically controlled gas heaters heat the building.

At No Extra Cost

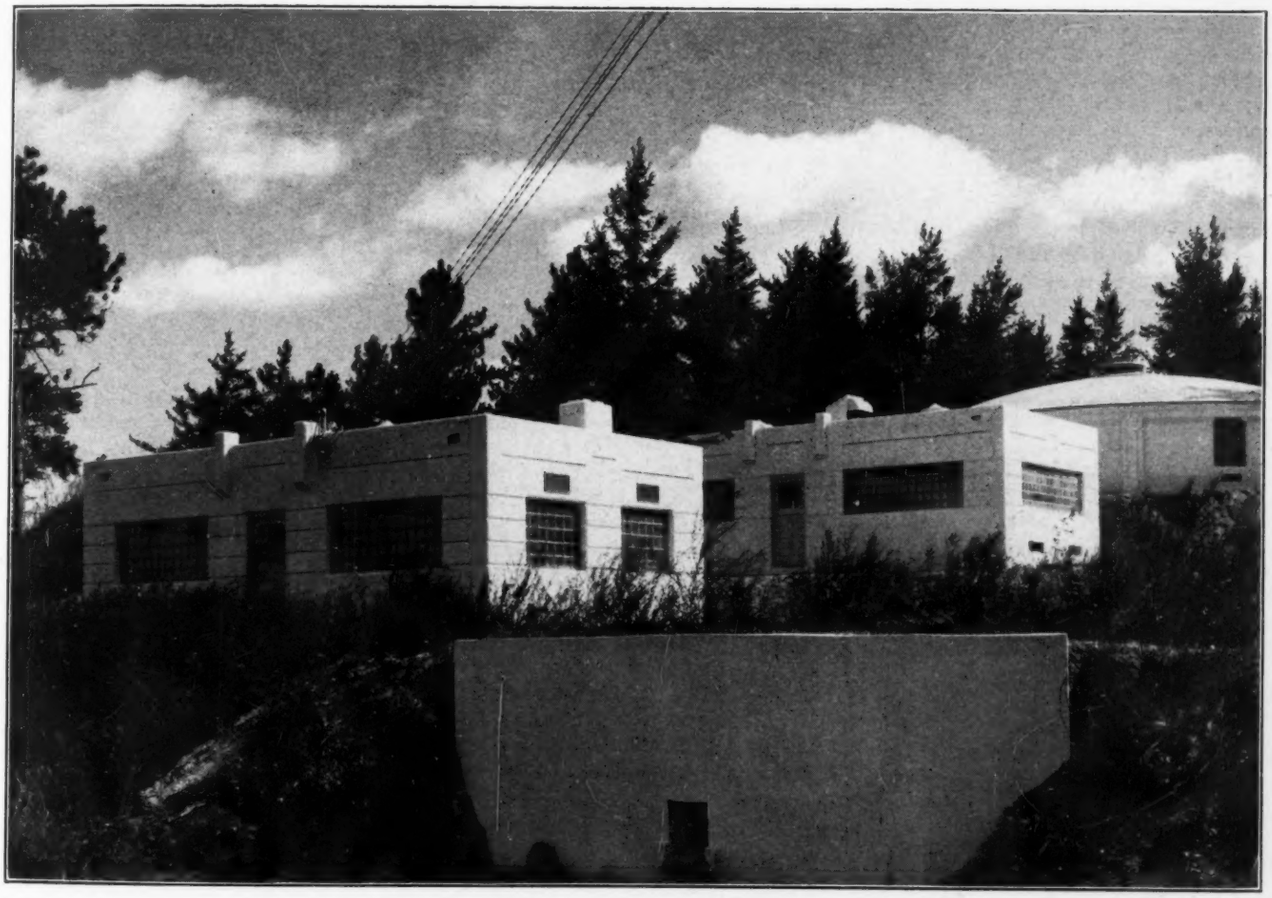
The architectural merit of this building was achieved at no more cost than would be required for an ordinary shop structure. Except for pumping equipment and fees the building cost only $15,380. The structure was designed by Long and Thorshov, Minneapolis, engineers, and was built by C. G. Victorson, also of Minneapolis.

For securing architectural detail more elaborate than that found in the Faribault waterworks, forming is comparatively easy. Simple details in rustications, pilasters and reveals may be secured by nailing molding strips onto the inside of the exterior forms or by blocking the forms themselves to secure the desired finished lines. Where intricate archi-

tectural detail is desired, the concrete is often cast in plaster waste molds, which are set in the forms and secured in whatever manner appears to be best in the individual case.

Usually, however, for both water and sewage works buildings architectural ornamentation is restricted to horizontal or vertical lines, or both. These are simply secured through pilasters and rustications spaced so as to break up plain areas, as revealed in the accompanying photographs which were supplied, at our request, by the Portland Cement Association to reveal the impressiveness of architectural concrete which adds little if anything to construction costs in providing attractive water and sewage works buildings.

Interior Treatment of the Fergus Falls Filtration Plant



The Sewage Treatment Plant of Bagley, Minn.
Built at a Cost of Little More Than $50,000, *and Definitely Attractive.*

TRAINING WATER WORKS OPERATORS*

By I. M. GLACE
Consulting Sanitary Engineer
HARRISBURG, PA.

IT IS UNNECESSARY for me to say that it is a decided pleasure to discuss with you, collectively, a matter which has been a subject of conversation individually with many members of this association on various occasions; a matter, moreover, which has been of concern to me for years, and at the present moment consumes a large proportion of my time in some one or other of several forms. How successful have been these efforts on training of operators is not for me to judge, but within the always limited sphere involved in the time factor, some advances seem to have been made in the production of a water of better quality, in more economical operation,—and we believe this to be highly important—in raising the morale of the operators contacted.

It is suggested, during the discussion of this subject, that you, as managers, will consider that reference is made primarily to the operators of the smaller plants, and not to those of larger units which are of such size that full-time technically trained men have been retained and are in charge of the operations.

The Question of Expediency or Necessity

First, let us ask, is there any necessity for the training of the operators of these smaller works?

The mere fact that the speaker has been asked to discuss the subject is an indication of a lack somewhere in the training of the present operators. The continuing cry, likewise, for the licensing of operators directs our thoughts in the same direction, as does the formation of water works short courses by educational institutions, and by water works associations for the dissemination of information among operators; which associations generally have been sponsored by state departments, at considerable effort. The same methods for the improvement of operation of sewage works are being used—a field which is fast developing and is equally a technical activity of the sanitarian.

It would seem to be untactful to tell a man that he needs training in his chosen occupation, but in the speaker's opinion, nobody need feel that any reflection has been placed on his ability by answering the question in the affirmative. We all need additional training; how much is only a matter of degree, with a man's ambition as the governing factor.

The Author
[Secretary, Pa. Water Works Operators Assn. and Director-Elect of A.W.W.A.]

In the water works profession the desirability for additional training is more pronounced than in some other forms of effort, primarily because it is largely in the field of public service; although, recently, coincidental with other research, industrial plants are studying this product in an effort to improve their manufactured materials, or to reduce the cost of water treatment.

Again, in the water works field, the rate of turnover among employes is comparatively low; the average operator has occupied his position for many years, during which time the advance in technical control of water works has been quite rapid; so rapid in fact as possibly to have left the profession, as a whole, somewhat unprepared for the many problems created, in these intervening years, by the demand of the consumers for a more perfect product. The public generally has become more vocal and the necessity for technical control of water works more insistent, with the end not yet in sight as the science of water purification progresses.

That there is a widespread necessity for training of water works operators can, therefore, hardly be questioned, which, as has been said, is no reflection on the present corps of faithful, earnest employes. It is simply another indication of similar advances in all fields of work.

Where Training Is Most Needed

In an effort to prevent any tendency to ramble during the discussion, some consideration also should be given to the limits of this training problem. So that, again, we ask, training in what branch of the profession? Certainly not in purchasing, nor in administration, nor in accounting, nor, generally speaking, in public relations, nor—to introduce a note both tragic and comic—in the preparation of governmental reports, since these duties, as well as many others, are usually confined to the main office of the water company. Through a process of elimination, it seems to me, and the same conclusion has been reached by others, that "training of operators" customarily refers to training in those phases of operation dealing with the quality of water, rather than those concerned primarily with quantities and pressures, which latter phase is best illustrated by the operation of pumps, service lines, mains, fire hydrants, and other distribution units.

The "blind spot" in the average operator's education, and the one on which light needs most to be thrown, is purification of water, which involves largely such sciences as chemistry, bacteriology, biology, mechanics, physics and hydraulics, all highly specialized fields of training, and fields which demand a degree of training that no manager or superintendent can—in justice to the operators—expect of any but a high priced technician. It is entirely probable that many managers, those men at the head of both publicly and privately owned water works, would be willing to confess freely and without embarrassment some deficiencies in at least one or more of these essential requirements of a competent filter superintendent. Nor do we feel that the managers must of necessity have such knowledge. It does seem vital, however, that they should recognize the importance of these studies, and should be ready and willing to maintain on their staffs, even if only on a part time basis, competent persons from whom to seek advice as the occasion requires. No matter how large or how small a water supply is, the problems of water purification have the same

*A paper read before the Penna. Water Works Association and here reproduced by permission.

values. It is only the volume of water delivered to the consumer which varies in extent, not the size of the problem.

That the importance of this matter has already received consideration is evidenced by the employment by the larger holding companies of a staff of technically trained men who, as "trouble shooters," serve all of the underlying water company units, at what probably is no very great expense to each of the individual units. This same principle of operation is also used in other phases of the operations of these companies.

Specific Operating Problems

All of the foregoing is rather abstract, so that a recitation of only a few of the many specific and practical problems encountered in operation may be worth discussion if only to emphasize the necessity for technical control.

Of these, the first in importance is chlorination, which is an almost universal safeguard against epidemics of water-borne diseases and is often vital to the successful purification of water.

At the meeting of the Pennsylvania operators at State College last month, in response to a question from the floor, it was developed by the many experts present that no less than ten chemicals or combinations of chemicals will produce colors in test tubes resembling that caused by residual chlorine when using orthotolidin as an indicator. These chemicals are known as interfering substances, and the color found as a false residual. Such false colors may mislead the operator into believing that sufficient chlorine has been added to the water as to safeguard the supply; in other words, disinfection presumably has been completed, when, as a matter of fact, it has not. With so many possibilities, if not probabilities, for error in this seemingly simple test, it is obvious that some technical training is essential for proper evaluation of the results obtained, and to determine where safety of the water begins and ends.

In one community which had been recording positive chlorine residuals for a number of years, it was demonstrated that a greater color could be produced in the raw water with otolidine, before any chlorine had been added, than was present in the finished water after chlorination. In this instance the actual chlorine dose had to be increased to approximately five times its former rate before a true chlorine residual was found in the effluent from the plant.

In another community seemingly very heavy residuals can be secured at any time on the distribution system, in amounts up to ten times the total post-chlorine dose, which is obviously impossible. This form of interference with the chlorine residual test, it is believed, is quite common.

Again, on a privately operated system, tuberculation of pipes had become increasingly pronounced, with marked reduction in the carrying capacities of the mains and service lines. In an attempt to remedy this condition, the operators began the addition of hydrated lime to the filtered water, which is a common practice. Immediately a severe outbreak of red water occurred throughout much of the system, driving the managers to despair. A prolonged study of this phenomenon revealed that the lime was being added under indifferent control, and also that certain basic principles were not understood nor used. The continued application of the chemical in the proper amounts, based on sound technical practice, not only cured the red water troubles, but also resulted in the production of a better water; and, as was originally intended and desired, provided for a large degree of protection for the mains and service lines.

In a smaller community (municipally operated plant) the average yearly cost of chemicals for purification was about $2,500. Without any lowering of efficiencies, and through the exercise of technical control, this cost was reduced to about $1,000 a year. In this instance, reliance on the judgment of an earnest but unskilled operator was costing the municipality about $1,500 annually.

Still again, in another community, tastes and odors were continuously present in the tap water. These tastes and odors the residents blamed on the use of too much chlorine, a common conclusion by the consumer but a conclusion which very frequently is not founded on fact. In this case, faulty operation throughout all purification processes contributed to the unsatisfactory results, with however, the use of alum in quantities too small to produce proper coagulation as the principal factor. A general tuning up of the purification processes helped in eliminating the trouble, but undoubtedly a use of sound basic chemical control knowledge was mostly instrumental.

This problem of taste and odor control is so highly involved that even the most expert operators sometimes have difficulty in ascertaining the causes. In this particular, but very important field of operations—tastes and odors—an unusually high degree of technical training is required if maximum results are to be secured.

Still another and very frequent difficulty is cited, involving the proper interpretation of bacterial analyses. A report is received from the laboratory which indicates an increase in the total numbers of bacteria. With no background in experiences and no sound education in bacteriology on which to base an interpretation of the report of the bacteriologist, the operator immediately increases the chlorine dose. In one community this practice of constantly increasing the amounts of chlorine applied to the water resulted finally in the application of the chemical in such quantities as to cause disagreeable reactions when tea and coffee were made from the tap water. It is quite probable that the so-called chlorination "breakpoint" had been considerably exceeded, at times, during these operations.

Careful control of the chlorine dose in this community has resulted in satisfied consumers without lowering the efficiency of bacterial removal and without affecting the safety of the supply.

It is hoped that these few examples of typical and ever-recurring problems will convince you that training of operators is an essential of good operation. And although there seems to be no quick method for securing such training, several concrete suggestions are offered for your consideration as steps in the right direction.

Have Your Operator Attend Water Works Conventions

These meetings have been organized usually by State Departments of Health, as has been said, at considerable effort by them, and for the express purpose of securing what they recognize as an essential requirement for the protection of the public health, that is, an improvement in purification practices. These conventions are actually training schools and most certainly are not municipal junkets or pleasure trips. When your operator asks to attend these meetings, be glad of it, and give him all the aid possible; if he doesn't ask, send him. You, yourself, are free to move around and to find opportunity to break the monotony of your routine, but quite frequently the operator is not so fortunately placed. He often spends 7 days in each week, for 52 weeks in the year, and sometimes for years at a time, in the same place, with never a change. Several plants come to

mind, located at isolated storage reservoirs, where the operators see nobody but their families for days at a time. The operator needs, just as everybody else does, a chance occasionally to get out of his rut, to contact other operators, and to find out that he has a definite place in a great profession. Remember that you have a monopoly in your community; a banker, a lawyer, a doctor can find in his own town other members of his chosen field of work with whom to confer, but the water works operator, perforce, must visit other towns and attend meetings to trade data and experiences on operation.

The free discussion at these water works meetings, between person and person, adds to the operator's knowledge, stimulates his interest and his pride in his work, and broadens his views.

Subscribe for Water Works Trade Magazines for Your Operators

I have in mind especially three journals—WATER WORKS AND SEWERAGE, *Water Works Engineering*, and *Public Works*. The total cost of these three magazines, on a two-year subscription basis, is less than $5 a year, a cost within the purchasing power of any company or municipality. Your operator will find in these trade papers many answers to the problems troubling him, couched often in non-technical and easily understood language. If he is a good operator and interested in his work, he will read and digest much of the material in these journals; if he doesn't show any interest in this type of literature, then, frankly, in the speaker's opinion, he is quite probably the type of man not best fitted for the purification field.

Dress Up Your Plant

At the State College meeting just held, Frank Jones, a consulting engineer of Cleveland, offered a startling but most interesting thought. He suggested that each time the consumer opened the tap in his home for a drink of water, there should appear on the wall, in front of the thirsty client, by television control, a picture of the plant from which the water was drawn. Certainly, in many cases the picture so seen would not produce a favorable reaction on the consumer. Your plant is essentially a food emporium and the same degree of cleanliness required of a restaurant should be one of the requirements of the filter plant and its surroundings. It is suggested that when you return home you try such a visualization of your works; if you are not satisfied with what you see, you may be sure your customers will be still more critical.

You may feel that this suggestion on the appearance of the plant has little to do with training of operators. We feel it does apply, and that an improvement in appearance of the plant will result in a more energetic, more responsive operator and will influence him to place a maximum value on his efforts.

Visit Your Plant Frequently

Too frequently operators complain that they have not seen the "boss" for several weeks, or months, and in the case of the directors of the companies, sometimes not for years, if ever. Your operator will welcome your visits, and your advice on methods of operation, and you will be in better position to make intelligent purchases of those pieces of equipment which are, in the operator's opinion, vital to the continued successful operation of the works.

Give the Operator the Technical Assistance He Needs

Some coaching of the operators, through personal contact, as practiced by the holding companies, is certainly advisable as a means to the desired end of training of operators. Under certain circumstances such assistance becomes mandatory. When the coaching is tactfully done, your operator most certainly will welcome such assistance.

And now a word as to licensing of operators which, when the proposal is made with honest intent, is almost always sponsored by the officials of State Health Departments or by other educational agencies. When a non-technical operator advocates licensing, he often has in mind tenure of office which, he hopes, will follow such licensing. The two are, of course, distinct problems. If a study is made of most licensing acts it will be found that a very lenient grandfather's clause is included—as it most certainly should be—with, however, rather strict provisions as to new operators, the obvious intent of which is to bring into the field men trained in the sciences, and the eventual elimination of operators who have not been afforded this opportunity.

Men of science cannot be made of operators who do not have the fundamental education to advance to higher planes, nor should all the present operators be required to attempt such a difficult task. Water companies can, however, each in its own community, attempt to provide adequate compensation to attract to its staff properly trained personnel; so that, eventually, over a period of years, as vacancies occur, there will be built up a force of competent persons to handle the problems of present day practice, and to meet the ever increasing demands of the public for a safe, clean, soft, non-corrosive, and palatable water. If and when such operators have been secured, the cry for licensing will abate or cease.

To the speaker the greatest curse of the purification field at the present time is a lack of palatability and the resulting inference that proper methods of operation are not practiced either because of ignorance or neglect, or both. In too many cases the water as it reaches the consumer is of only indifferent quality. It is not bad enough to cause open complaint, but only remote rumblings and a sense of dissatisfaction. One of the results of this indifferent operation is the sale of bottled water in a community in any considerable quantity.

To climb over this hump of an indifferent quality and into that state of quality where the consumers point with pride to the final product, is a job for a trained man. So many factors enter into the methods of preparation of raw water, in coagulation control, in care of filters, in corrosion prevention, in chemical disinfection, and in the interpretation of analyses, as to make it practically impossible for an untrained operator to reach this goal. It is not intended to convey the impression that a knowledge of the subjects previously outlined —chemistry, biology, etc.,—are in themselves sufficient to make a trained operator but simply that they are bases on which to build the experiences vital to proper operation. Nor is it intended to suggest that it is impossible to make definite advances in operation without such basic training. Quite skillful operators can be, and have been made, of operators without fundamental education and with only a reasonable amount of aid from the proper sources.

The educational agencies are available to you, and they are yours to command.

In Retrospect

Summing up, it is probable that we can make certain reasonable conclusions:

1. There is a definite need for training of operators.

2. A number of agencies are at work to provide the knowledge required for better operation by existing operators.

3. Advancing science demands a

better product, which can be supplied only by technically trained men.

4. More adequate compensation must be provided if the profession generally is to attract trained operators into this field.

5. *And Finally*—There is no quick specific for the existing conditions, and only over a period of years can large advances be expected. These advances must be made if demands of the consumers are to be met.

Circulating Liquid Volume in Horizontal Cylindrical Tanks

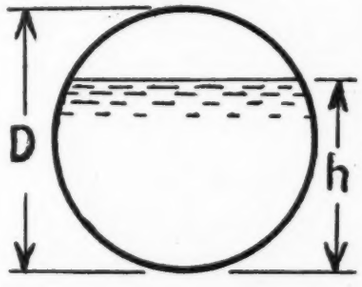
By W. F. Schaphorst, M.E.,
Newark, N. J.

Several charts have been developed for the determination of contents of cylindrical tanks lying in a horizontal position, and, of course, there are tables, but this writer has been asked for a simple formula suitable for more accurately computing contents without the use of charts.

Charts, at their best, cannot be as accurate as formulas, but charts are excellent nevertheless for approximate determinations and for checking the results obtained from formulas.

Here is a new formula based on a very excellent formula for areas of segments of circles given by Prof. John Goodman in his "Mechanics Applied to Engineering." The chief objection to Prof. Goodman's original formula is that it involves two different chords and it does not include the diameter at all. This new formula is therefore based on a modification of Goodman's formula, reducing it to two factors—the diameter of the circle and the height of the segment. As a result, this formula for horizontal cylindrical tanks is offered:

$$G = .0023hL\ (1.5\ \sqrt{Dh - h^2} + \sqrt{Dh})$$



Where

G = Number of gallons of liquid in the tank;
h = Height of the liquid, in inches;
L = Inside length of the tank, inches;
D = Inside diameter of the tank, inches.

But this formula is not applicable when the tank is more than half full. In other words, as soon as the height of the liquid becomes greater than one-half of the diameter of the tank, one must determine the empty space from the volume of a full tank. The remainder, of course, is the liquid in the tank. The formula for such situtions—where the tank is more than half full—is as follows:

$$G = L\left[\frac{.0034D^2 - .0023\ (D-h)}{\{1.5\ \sqrt{h\ (D-h)} + \sqrt{D\ (D-h)}\}}\right]$$

This writer has been searching for a truly simple formula on this subject for more than 30 years. If any reader has a simpler one than the above it will be appreciated by the writer and doubtless by many others.

[In connection with this problem of determining contents of horizontal tanks filled to various depths, the reader will find a simpler approximate formula and a table of values for tanks of various diameters on page 263 of the 1941 Reference and Data Issue (June) of this magazine.—Ed.]

$10,000,000 Public Works Program for Norfolk Area

For the city of Norfolk, Va., and contiguous areas a $10,000,000 Public Works program has been set up incident to the defense activity in the Hampton Roads area.

The cost of this extensive project or projects is to be shared by the Navy Department, the Defense Public Works Agency and the city of Norfolk. A major share is being borne by the first two because of the national aspects of the defense activity which necessitated the betterments planned.

Abel Reynolds N.E.W.W.A.'s Treasurer Passes

Abel Reynolds

Abel Reynolds, General Manager and Treasurer of the New England Water, Light and Power Company, Providence, R. I., passed away in his home in Providence on February 12th after an illness of two months.

Mr. Reynolds has for the past several years served as Treasurer of the New England Water Works Association, in which position he has given keen "watch-dog" service while improving the financial picture of America's oldest water works association.

Mr. Reynolds was born in Providence, R. I., May 5, 1870, where he has long been known as a public spirited citizen and community leader. He was president or vice-president of several water works companies owned and operated by the New England Water Light and Power Co., of which he was General Manager.

N.E.W.W.A. has lost a valued member and treasurer and Providence a respected citizen.

Dayton Loans Tatlock to War Department

Loaned to the war department for at least six months, M. W. Tatlock, Superintendent of the Dayton Sewage Treatment Plant, is stationed at Columbus, Indiana, as Assistant Chief Engineer of a $40,000,000 Army cantonment to house 40,000 soldiers.

In his new post Mr. Tatlock will supervise a staff of 600 engineers and inspectors for the Charles H. Hurd Co., Consulting Engineers of Indianapolis, who have the engineering contract. In fact, he was connected with the Hurd Co. prior to 1928, when he became superintendent of the Dayton sewage treatment plant, after he had supervised its construction.

DIESELS IN WATER WORKS PLANTS

How Much Fuel Do They Consume?

By W. F. SCHAPHORST, M.E.
NEWARK, NEW JERSEY

"IF WE should install a Diesel engine in our water works plant, how much fuel will it consume?" That question is often asked by officials who are considering the use of a Diesel engine for power purposes.

It is an important question and is too often "sidestepped" by salesmen who are afraid of committing themselves. The usual reply is that it all depends upon "this or that," and the prospective user is mystified by the intricateness of the situation. As a result, the prospect becomes "afraid" of Diesels.

Size vs. Fuel Requirement

This writer will now make an effort to answer the above question definitely. He has gathered data on fuel consumption by modern Diesels of numerous sizes and has prepared the following table. This tells at a glance what good Diesels are doing today, the horsepower varying from the smallest sizes up to and including 3,000 h.p. The table applies to full load conditions.

Horse Power of Diesel	Pounds of Fuel Used Per H.P. Per Hour
50-60	0.45 to 0.44
60-70	0.44 to 0.43
70-110	0.43 to 0.42
110-260	0.42 to 0.41
260-500	0.41 to 0.40
500-1,000	0.40 to 0.392
1,000-2,000	0.392 to 0.391
2,000-3,000	0.391 to 0.39
3,000-and up	0.39 or less

Thus, for instance, if your requirements are very small (50 h.p. or even less) you can figure on a fuel consumption of 0.45 lb. per h.p. per hour with a modern engine. If you need a 100 h.p. Diesel, the consumption will be about 0.42 lb. per h.p. hour. The table shows that with increase in engine size the fuel consumption improves rapidly from the smallest sizes to 260 h.p. From 260 to 1,000 h.p. the improvement is less rapid, and from 1,000 to 3,000 h.p. the improvement is very slight, being practically 0.39 lb. per h.p. per hour for all of the sizes in that range as well as for larger sizes.

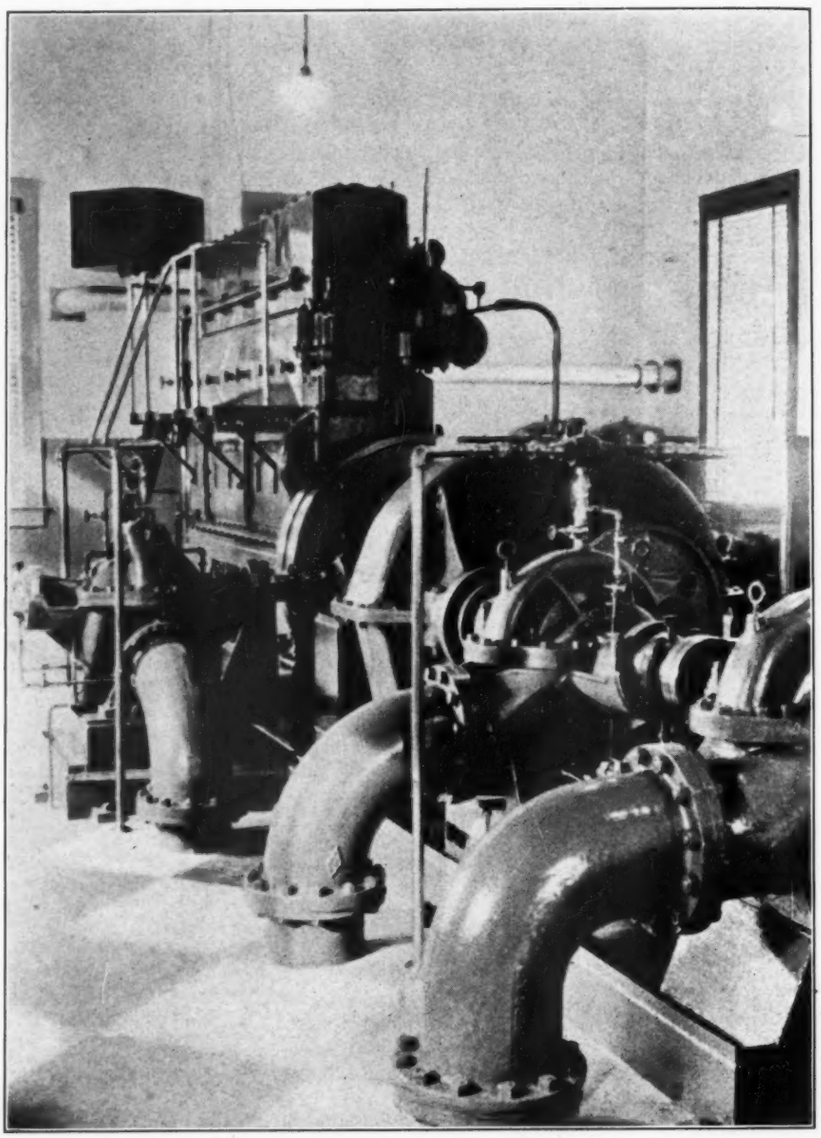
Determining Efficiency

Should you want to determine the efficiency of any engine size, with any fuel, multiply the B.T.U. value of the fuel per pound by the number of pounds per h.p. per hour and divide the product into 2,546.

As an example, if the fuel contains 20,000 B.T.U. per pound and you will require a 500 h.p. engine, the table shows that you must multiply 20,000 by 0.40, which gives 8,000 as the product. Now divide 2,546 by 8,000 and it will be found that the engine will have an efficiency of 31.8 per cent, which is a high efficiency as compared with most engines of other types. It means that 31.8 per cent of the heat contained in the fuel will be converted into work. Even at 0.45 lb. of fuel per h.p. per hour, other conditions being the same, the efficiency will be 28.3 per cent, which is still a high efficiency for any engine.

Fractional Loads

The above figures relate solely to Diesels that are carrying 100 per cent load, which means that conditions are best for minimum fuel con-



Diesel Driving Centrifugal Pumps
The unit operates at 450 r.p.m. and is connected by gears to the pumps. Note that one of the pumps is driven by a shaft operating at right angles to the main shaft.

sumption. However, since Diesel engines are commonly operated at less than full load, it is also important that prospective users should know what the fuel consumption at such loads will be. This information should be known in advance.

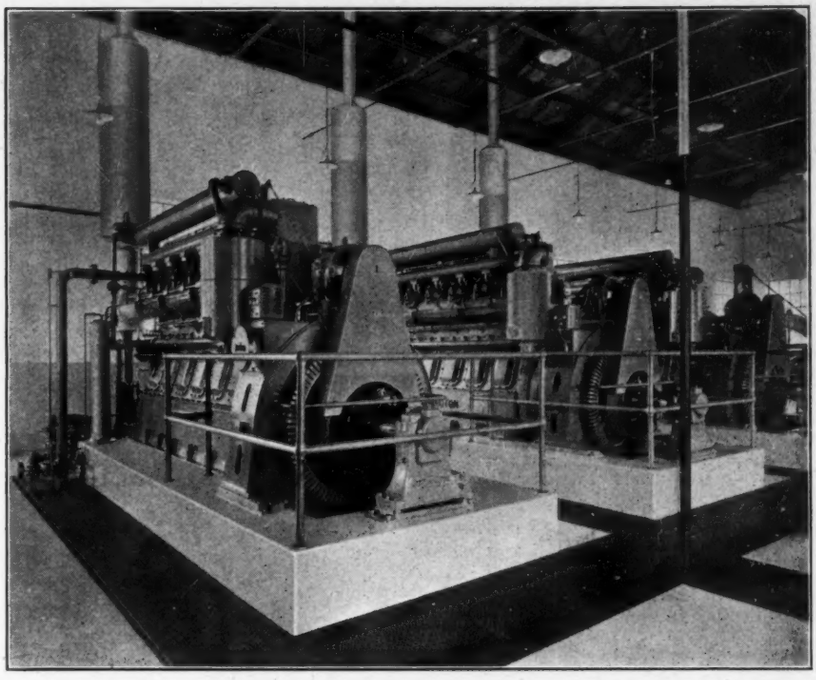
Under average conditions, using the *good* Diesels mentioned above, the writer offers the following figures as being applicable.

Per Cent of Load	Multiply the Figures in the Above Table by
100 to 85	1.000
85 to 70	1.010
70 to 62	1.035
62 to 56	1.060
56 to 52	1.085
52 to 48	1.110
48 to 46	1.136
46 to 44	1.160
44 to 42	1.183
42 to 40	1.210
40 to 38	1.232
38 to 36	1.260
35	1.306
34	1.327
33	1.348
32	1.370
31	1.392
30	1.415
29	1.438
28	1.462
27	1.486
26	1.511
25	1.536

Thus, for example, if you should be contemplating an 100 h.p. Diesel, and if it is quite possible that the engine will be operating at 25 per cent of full load most of the time, as is not at all uncommon in practice, the fuel consumption at that load is obtained by multiplying the 0.42 in the first table by the 1.536 in the second table. As a result we have

$$0.42 \times 1.536 = 0.645$$

In other words, the fuel consumption will be approximately 0.645 of a pound per horsepower per hour, or 64.5 pounds per hour for the engine, since it will be an 100 h.p. engine.



A Fairly Large Installation

In the plant of the Dominguez Water Co. near Los Angeles, Calif., these three Worthingtons are rated at 385 h.p. each, at 428 r.p.m. Each engine is direct-connected to a 330 k.v.a., 265 kw., at 0.8 power factor. Excellent arrangement for handling widely fluctuating loads.

MUNICIPAL ENGINEER'S DEPT.
Municipal Office.
P.O. Box № 800.
Singapore. 20th November, 1941.

CCC/LCS.

IT IS REQUESTED THAT THE FOLLOWING NUMBER BE QUOTED IN THE REPLY TO THIS LETTER.
№ 1030/Y/41

FEB 24 1942

Edward B.Mallory, Esq.,
Director,
Lancaster Research Laboratories,
Hackensack, New Jersey, U.S.A.

Dear Sir,

Your paper entitled "Oxidized Sludge Process and the Equilibrium Index" published in "Waterworks and Sewerage" has been read with much interest and I shall be obliged if you will give me particulars of the patent rights for the method of control described.

The method of control would, if adopted, be used for a partial treatment plant which has recently been put into operation and is now treating 2,800,000 g.p.d. (half of initial designed capacity). The bio-flocculation unit gives an aeration period of 2.3 hours of the mixed liquor and the returned sludge is re-aerated for 8.8 hours. The reduction effected averages 65% of the 4 hour B.O.D. and 85% of the suspended matter. The final settling tanks have deep conical bottoms, so that the maximum water depth is thirty-five feet. This may effect the use of a sludge blanket detector, which has not yet been used on the plant.

I shall be glad if you will say whether, in your opinion, the above mentioned factors are likely to affect adversely the method of control.

Thanking you in anticipation,

Yours sincerely,

C. COLLUM.
Asst. Sewerage Engineer.

Just Too Late, Singapore!

The accompanying reproduction is of a letter from Singapore which arrived a little late. Interestingly, it came in but two days after Singapore had fallen.

From the mailing date of November 20th and receipt date of February 24th, it will be noted that 3 months and 4 days elapsed in transit.

While it would be interesting to have this letter tell us its history during this lengthy period of travel, it would be more interesting if we could know what the writer of it—C. Collum, Ass't Sewerage Engineer of Singapore—is being faced with under the changed order of things in Singapore.

The Editor's Comments

"Keep IT Flowing"

THIS open letter, broadcast to A. W. W. A.'s members by Secretary Jordan, rather hits the nail on the head and we think it worthy of the greatest possible attention. On this score we are reproducing the letter in full on this page.

The Sixty-second Annual Meeting of the American Water Works Association is not to be a "convention." It will be, instead, a

CONFERENCE ON WARTIME WATER WORKS PROBLEMS

Is such a meeting worth while? Let's think about it. When water works men have gathered in their meetings during previous years, they have exchanged ideas about ways of handling their common problems, listened to speakers who had solved special problems and studied new equipment offered for use in the field.

Is there need for that in 1942? Was there ever a greater number of new situations confronting *all* water works? "What can I use instead of what?" "How can I get it?" "When?" Were there ever more special problems? Priorities! Bomb Damage! Guarding Property! Were manufacturers ever more active than they are now devising ways to use new materails to fill old as well as new needs?

Are people interested in such conferences? Do they attend? Have you ever seen water works men sit in a morning session till 1 o'clock? I have—*in 1942*. Have you seen them standing around the walls, because there were no more chairs to be had, while someone talked about water works problems? I have—*in 1942*.

Have you seen Americans in deadly earnest, trying to do their part to make America go? Of course—you are seeing it everywhere today!

These are some of the things that convince me that the A.W.W.A. "Conference on Wartime Water Works Problems" will be the most useful gathering the Association has ever sponsored. No more accessible location than Chicago and the Stevens Hotel could have been found for these sessions that start on June 21st. Nothing but emergency will keep away from this 1942 meeting, *the water works man who feels his responsibility to his consumers* and wants to give them all the service they need for doing their part in this war.

Harry E. Jordan, Secretary,
American Water Works Association.

March 11, 1942.

We take it that Mr. Jordan distributed this letter for the same reason that we are reproducing it—namely, because there are *some* who consider the holding of meetings or conventions during the present emergency as of questionable wisdom if not actually unwise. There are others who have a feeling that they should not leave their responsible posts for the period required to attend a large or distant meeting at such a crucial time.

It is our opinion, as it is of A. W. W. A.'s Executive Committee and Board of Direction, that there is more genuine reason for a dissemination of information on water works practices, policies and management, under present circumstances and possible future conditions, than can be argued for peace time. Realizing this and considering the seriousness of the situation and the business at hand, it is to be noted that the 1942 Annual Meeting is *not* to be a convention but rather a "Conference on Water Supply Problems in Wartime." The entire technical program and the general plans for the Annual Meeting in Chicago is definitely being planned with the business at hand uppermost in mind. Those who might be planning to come to the 1942 meeting for a frolic will find the degree and pattern of entertainment customarily found at A. W. W. A. Conventions somewhat lacking. As a matter of fact, there is under contemplation the shortening up of the meeting by a full day and dropping some of the less timely material from the technical program, utilizing for technical sessions the Wednesday afternoon customarily devoted to leisure and inspection trips, and dropping out one evening of entertainment. The program committee has pointed every effort toward securing the best equipped and qualified speakers and discussors on topics of specific interest and importance as wartime operating, maintenance, repair and management measures. The program is being framed to help the small plant operator as much as, if not more than, the large system operators.

Mr. Jordan comments on the large attendance at sectional meetings during 1942 and the interest and close attention manifested, as attested by the packed meeting rooms and empty corridors. This, to his mind and to ours, is evidence sufficient to indicate the need for meetings of water works men NOW—not after it becomes too late to benefit from an exchange of ideas and a knowledge of preparedness in water supply practice.

In the direction of deciding whether its meetings should be held in 1942 as in other years, or curtailed, the Board of Direction of the American Society of Civil Engineers discussed the question at length before deciding that meetings of engineers were to be considered more important this year than in peace time. This Board also decided to curtail the entertainment feature of its meetings and specified technical programs dealing with topics of especial importance in war time. The Society will hold the customary four meetings.

As to meetings in 1942 of water works men, we have noted that every meeting at which emergency situations and preparedness has been featured on the program, the best attendance and closest attention of the audiences have resulted. This in itself attests the need for the greatest possible dissemination of war-time operating and maintenance information. In no other way can this be done better than in meetings.

Also, we would add, it has been the observation of this writer that in those sections where the greatest number of water works meetings have been held recently, more advance preparations and preparedness programs are to be found amongst the water works in those areas than in other sections of the country.

The program of the 1942 Conference of A. W. W. A. has been framed to help every water works man in America in these trying times, and its importance cannot be over-stressed. Don't let your community down!

L. H. Enslow

MEETINGS SCHEDULED

Mar. 19—BOSTON, MASS. (Hotel Statler)

New England Water Works Association. Secretary, F. J. Gifford, 613 Statler Bldg., Boston, Mass.

Mar. 25-27—EAST LANSING, MICH. (Union Bldg., Campus)

Michigan Sewage Works Operators Conference. Sec'y-Treas., W. F. Shephard, State Dept. of Health, Lansing, Mich. (Preceded by 2 day Short Course, Mar. 23-25.)

Mar. 26—TRENTON, N. J. (Stacy Trent Hotel)

New Jersey Section A.W.W.A. Secretary, C. B. Tygert, Box 178, Newark, N. J.

Apr. 2-4—COLUMBIA, MO. (Univ. of Missouri)

Missouri Water Works Short Course. W. W. Towne, Ass't Prof., Dep't Civil Engineering, University of Missouri, Columbia, Mo.

Apr. 9-10—LAFAYETTE, IND. (Purdue Memorial Bldg.)

Indiana Section A.W.W.A. Sec'y, H. G. Horstman, Supt., Water District, Public Service Co. of Indiana, Traction Terminal Bldg., Indianapolis, Ind.

Apr. 10-12—TUCSON, ARIZ. (Pioneer Hotel)

Arizona Sewage & Water Works Association. Secretary, Richard Bennett, City Water Dept., Phoenix, Ariz.

Apr. 13-15—FAYETTEVILLE, ARK. (Engineering Bldg. Univ. of Arkansas)

Arkansas Water & Sewage Conference. (12th meeting.) Secretary, Harrison Hale, 114 Chemistry Bldg., Fayetteville, Ark.

Apr. 15-17—NIAGARA FALLS, ONT. (Gen. Brock Hotel)

Canadian Section A.W.W.A. Sec'y, Dr. A. E. Berry, Director, Ontario Dept. of Health, Parliament Bldg., Toronto, Ont.

Apr. 17-18—HELENA, MONT. (Placer Hotel)

Montana Section A.W.W.A. Secretary, Ralph Miracle, 713 Lewis Ave., Billings, Mont.
(Preceded by two-day short course Apr. 15-16)

Apr. 20-22—ATLANTA, GA.—(Ansley Hotel)

Southeastern Section A.W.W.A. Sec'y, A. P. Rice, Supervising Engr., Reconstruction Finance Corp., Bond Service Div., Atlanta, Ga. (1 Day War Emergency Conference.)

Apr. 22-23—ROANOKE, VA. (Hotel Roanoke)

American Society of Civil Engineers. (Spring Meeting.) Secretary, George T. Seabury, 33 West 39th St., New York, N. Y. (The Sanitary Division Program is devoted expressly to defense topics.)

Apr. 23—PROVIDENCE, R. I. (Hotel Biltmore)

New England Water Works Association. (In conjunction with the New England Health Institute.) Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.
(Future Meeting—May—Manchester, N. H. (Manchester Country Club.)

Apr. 26-28—BAKERSFIELD, CALIF. (Motel Inn)

California Sewage Works Association. Sec'y-Treas., Jack H. Kimball, P. O. Box 355, Santa Ana, Calif.

(*Continued on page* 70)

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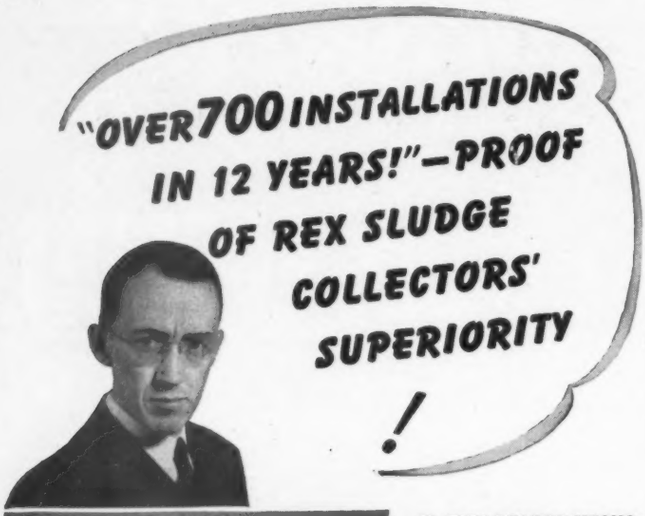

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MEETINGS SCHEDULED

Apr. 30-May 1—NIAGARA FALLS, N. Y. (Hotel Niagara)

New York Section A.W.W.A. (Spring Meeting.) Secretary, R. K. Blanchard, Neptune Meter Co., 50 West 50th St., New York, N. Y.

May 6—WALLA WALLA, WASH. (Marcus Whitman Hotel)

Pacific Northwest Sewage Works Assn. Sec'y-Treas., Fred Merryfield, Assoc. Prof. C. E., Oregon State College.
Corvallis, Ore.

(Meeting jointly with)

May 7-9—WALLA WALLA, WASH. (Marcus Whitman Hotel)

Pacific Northwest Section A.W.W.A. Sec'y, Fred Merryfield, Assoc. Prof. Civil Eng., Oregon State College, Corvallis, Ore.

May 14-15—TOLEDO, OHIO (Commodore Perry Hotel)

Ohio Section, A.W.W.A. Sec'y, Thomas R. Lathrop, 2328 Arlington Ave., Columbus, Ohio.

May 15—KENNETT SQUARE, PA.

Pennsylvania Water Works Operators' Ass'n. Sec'y, I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

(Meeting jointly with)

Southeastern Penna. Sewage Works Operators' Ass'n. Sec'y, Gordon J. Wiest, Sewerage Authority, Chester, Penna.

May 27-28—BOSTON, MASS. (Hotel Bradford)

New England Sewage Works Association. (Spring Meeting.) Sec'y-Treas., LeRoy W. VanKleeck, State Dept. Health, Hartford, Conn.

June 18-19—MINNEAPOLIS, MINN. (Nicollet Hotel)

Central States Sewage Works Association. (15th Annual Convention.) Sec'y-Treas., E. J. Beatty, 458 State Office Bldg., Madison, Wis.

(Note the change in schedule of this meeting from October in the past to June henceforth. This year the dates were purposely chosen to immediately precede the A.W.W.A. Convention, which is to be held in Chicago, June 21-25, with a day for fishing in between.)

June 21-25—CHICAGO, ILL. (Stevens Hotel)

American Water Works Association. (Conference on Wartime Water Works Problems.) Executive-Secretary, Harry E. Jordan, 22 East 40th St., New York, N. Y.

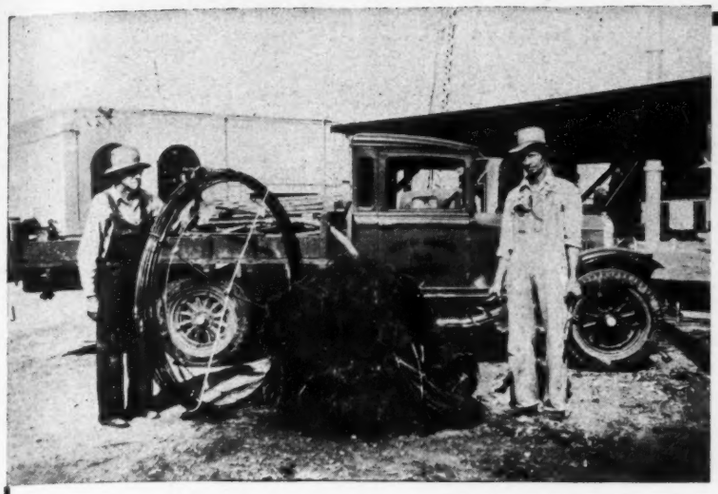
Aug. 24-26—STATE COLLEGE, PA.

Pennsylvania Water Works Operators' Ass'n. (Annual Meeting.) Sec'y, I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

Aug. 26-28—STATE COLLEGE, PA.

Pennsylvania Sewage Works Operators' Ass'n. (Annual Meeting.) Sec'y, Bernard S. Bush, State Dept. Health, Harrisburg, Pa.

(*Continued on page 72*)



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MEETINGS SCHEDULED

Sept. 9-11—TRAVERSE CITY, MICH. (Park Place Hotel)

Michigan Section, A.W.W.A. Sec'y, M. N. Gerardy, Sup't Water Supply, Water Board Bldg., Detroit, Mich.

(Meeting jointly with)

Michigan Conference on Water Purification. Sec'y, R. J. Faust, Dep't of Health, Lansing, Mich.

Sept. 15-18—POLAND SPRING, ME. (Poland Spring House)

New England Water Works Association. Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 18—PITTSBURGH, PA. (Roosevelt Hotel)

Western Pennsylvania Section A.W.W.A. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 24-26—ST. PAUL, MINN. (Lowry Hotel)

Minnesota Section A.W.W.A. Secretary, A. M. Finch, Wallace & Tiernan, Inc., 416 Flour Exchange, Minneapolis, Minn.

Sept. 25—NEW LONDON, CONN. (Ocean Beach Pavilion)

New England Sewage Works Association.) (Fall Meeting.) Sec'y-Treas., LeRoy W. VanKleeck, State. Dept. of Health, Hartford, Conn.

Oct. 12-15—

Southwestern Section A.W.W.A. Secretary, Lewis A. Quigley, City Water Works, 3320 W. Berry, Fort Worth, Texas.

Oct. 15-17—CLEVELAND, OHIO (Hotel Statler)

Federation Sewage Works Association. (3rd Annual Convention.) Sec'y, H. W. Wisely, Urbana-Champaign Sanitary District, Urbana, Ill.

Oct. 15-17—CLEVELAND, OHIO (Hotel Statler)

Ohio Conference on Sewage Treatment. (Meeting with Federation of Sewage Works Associations). Sec'y-Treas., W. D. Sheets, 568 E. Broad Street, Columbus, Ohio.

Oct. 19-21—PADUCAH, KY. (Irving Cobb Hotel)

Kentucky-Tennessee Section A.W.W.A. Secretary, H. D. Schmidt, Div. San. Eng., State Dept. of Health, Nashville, Tenn.

Oct. 22-24—ST. LOUIS, MO. (Coronado Hotel)

Missouri Valley Section, A.W.W.A. Sec'y, Earle L. Waterman, 104 Engineering Hall, University of Iowa, Iowa City, Ia.

Oct. 28-30—LOS ANGELES, CALIF.

California Section, A.W.W.A. Sec'y, H. Arthur Price, Dept. Water and Power, 316 West 2nd St., Los Angeles, Calif.

Nov. 2-4—DURHAM, N. C. (Washington Duke Hotel)

North Carolina Section, A.W.W.A. Sec'y, R. S. Phillips, Chief Chemist, Water Department, 206 Dacian Ave., Durham, N. C.

LITERATURE AND CATALOGS

Sprinkling Filters is the subject of a highly useful illustrated Data Book (No. 130) currently being released by the Pacific Flush Tank Company of Chicago. This 30-page book, punched for loose-leaf binding, contains a wealth of engineering data on secondary sewage treatment. There appear numerous design and flow drawings, and photographs of equipment and plants. Charts and tables facilitate computing the required filter bed for a given loading and give recommended nozzle spacings. After an introductory word on sanitation standards the book explains the design and operating features of the "separate nozzle field" and the "common nozzle field" filter systems; design data on single and twin dosing tanks are given, along with a description of the types of siphons used in them. Factors governing the selection of the laterals from dosing tank to nozzles are indicated. The four types of P. F. T. circular spray nozzles are illustrated to show the ease with which they are dismantled and cleaned by use of a special wrench and pliers. Another section describes the trickling filters especially designed for small communities or large institutions. Complete specifications for nozzles and for single and twin dosing tank equipment are given in a later section. For a copy of PFT's useful handbook on sprinkling filter design, titled Data Book No. 130, write to Pacific Flush-Tank Company, 4241 Ravenswood Avenue, Chicago, Ill.

Rex "Slo-Mixers" for water, sewage, and industrial waste treatment plants, are described in a new folder from Chain Belt Co. The multi-stage mixers provide the correct turbulence for maximum floc formation, and by decreasing this turbulence progressively (as floc size increases) the maximum floc production is attained preparatory to rapid settling in clarifying basins. The Rex "Slo-Mixer," designed to insure the absence of short-circuiting, is claimed to produce positive mixing with a minimum of electrical energy required. Several drives for the paddle shaft are available. A full-page line drawing of a typical "Slo-Mix" unit shows the location of paddles in relation to flow direction, and emphasizes the special baffle arrange-

(Continued next page)

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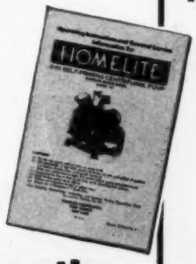

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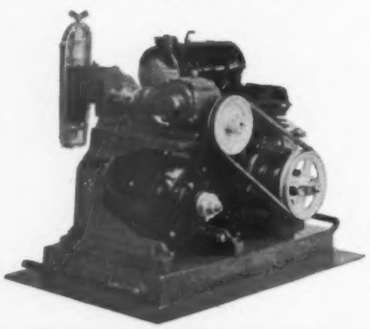

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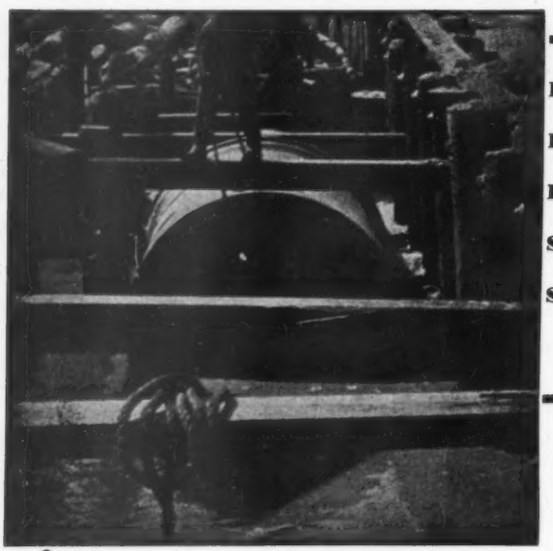

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ment for the prevention of short-circuiting. The folder contains photographs of several plants in which Rex equipment is in use. For a copy, request Bulletin 389, from Chain-Belt Co. (Sanitary Equipment Division), Milwaukee, Wis.

Transite Products and Insulating Materials, by Johns-Manville, are described and illustrated in the 1942 edition of their Industrial Products Catalogue. The profusely illustrated 52-page book discusses in detail most important J-M products. An introductory first page gives a little of the history of Johns-Manville research and a few general facts about the basic materials that are used. The majority of their insulating products are fabricated from five mineral substances—asbestos, magnesium carbonate, diatomaceous silica, rock-wool and refractory clay. Transite roofing and siding, movable partitions, refractory products, electrical conduit and transite pressure pipe are some of the outstanding products for which specifications and explanatory data is given. J-M transite pipe, now in common use for water distribution as well as process lines, is economically installed and requires little maintenance. Numerous other advantages of Transite and asbestos products are explained in the catalogue. A copy can be obtained by addressing Johns-Manville, at 22 East 40th Street, New York, N. Y.

A Sound Defense Program is outlined in a timely booklet from Wallace & Tiernan Co., which emphasizes a "7-Point Check-Up for Total Protection," each point being dealt with in some detail on the pages that follow. The center spread of the booklet is devoted to illustrated descriptions of the full line of emergency portable chlorinating equipment offered by W. & T., amongst which is the long known W. & T. portable field units for feeding chlorine gas and also the newer self-powered W. & T. hypochlorinators. The newest and most universally useful unit is the W. & T. Self Powered Trailer Chlorinator, providing high flexibility for any chlorinating duty that may arise. The booklet of course stresses the desirability of having duplicate chlorinating equipment and an ample stock of spare parts for the emergency. If you haven't seen a copy of "A Sound Defense

Program" request it from Wallace & Tiernan Co., Newark, N. J.

Worthington Type VS Air Compressors, described in a special bulletin, have been designed for users who require a small capacity machine that will stand up under severe service. Construction features are shown in cross-sectional photographs of three different models. These single-cylinder, single-stage compressors (available in both air and water cooled units) are recommended for such uses as paint spraying, light sand-blasting, pneumatic controls in general, and small air systems. The bulletin contains complete specifications of all models and a list of popular accessories. Selection tables and dimensional data are given. For a copy of Bulletin H-621-B8 describing this utility compressor, write to Worthington Pump and Machinery Corp., Harrison, N. J.

Truck Mounted Valve Operators are featured in an illustrated folder recently received from the Payne Dean Co., Peekskill, N. Y. These machines can be attached to the transmission of any truck if its case has been drilled for a power take off. The valve operating head is fastened to the truck frame by eight ½ in. bolts. A vertical key shaft operates the valve at a speed and power controlled by the truck throttle. The Dean "Valve Operator," especially recommended for present day emergency service, has sufficient power to close the largest valves and close them as rapidly as good practice dictates. A safety coupling and a Veeder-Root counter (indicating the actual number of turns made by the key) are part of the machine. For a copy of the new Valve Operator folder address Payne Dean Co., Peekskill, N. Y.

"Sterozone" is the name used by the Technicraft Engineering Company to describe their automatic equipment for water purification with ozone. The advantages of sterilization with ozone (O_3) as compared with chemical treatment are presented in a new illustrated bulletin. The "Sterozone" Model A is a complete pumping, filtration and sterilization water treatment plant. Ozone is generated by the silent blue electric discharge between aluminum plates maintained at 13,000 volts. Ozonized air is injected into a domed

(Continued next page)

SIMPLEX

for ACCURACY • RELIABILITY SOUND ENGINEERING IN FILTRATION PLANT EQUIPMENT

THESE factors — Accuracy, Reliability, Sound Engineering — have resulted in the past forty years in the installation of Simplex Rate of flow Controllers, Gauges, Venturi Meters in the world's finest filtration plants.

First to develop the Direct-acting Controller, the Master Control, the Bell-shaped Float, and the Sand Expansion Indicator, the cardinal policy of Simplex is to increase its usefulness to the waterworks profession by continued research, design and cooperative measures with both designing and operating engineers.

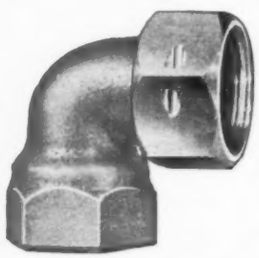
SIMPLEX PLEDGES ITS ENTIRE FACILITIES TO MEET THE DIVERSE PROBLEMS OF THE NATIONAL EMERGENCY.

Simplex Valve & Meter Company
68TH & UPLAND STS.
PHILADELPHIA

FORD
Ringstyle
VALVES
AND
COUPLINGS

The distinctive feature of these modern fittings is the means by which the meter coupling nut is attached securely after being put on over the flange.

RINGSTYLE Angle Valves attach to iron or copper pipe and couple direct to the meter. You save fittings, joints and space; the operating head of the valve is alongside the meter.



RINGSTYLE Couplings are made in angle and straight types, for connecting to copper and with female iron pipe threads. They can be provided with test valves also.

Ask for more information and free sample.

FORD
METER BOX
CO.,
WABASH, IND.

rectangular absorber, containing approximately 150 gallons of water undergoing treatment, and flows concurrently to the water in four separate stages. A simplified flow diagram shows all units of the compact plant, including water filters, absorber, ozonizer, and air compressing and cooling systems. Results of bacteriological tests made on samples of water from the Los Angeles River, before and after treatment with "Sterozone," are given in the final pages of the bulletin, along with a list of specifications for the complete plant. To obtain a copy of the bulletin write to Technicraft Engineering Company, 5610 South Soto Street, Los Angeles, Calif.

"Hypo vs. Gas" is the significant question posed in an 8-page letter recently distributed by Proportioneers Incorporated examining the relative costs of different chlorinating practices for swimming pools and water and sewage systems. Facts and figures on ten commercial sources of HTH, Perchloron, and sodium hypochlorite are listed, stressing the cost per pound of actual chlorine. The paper recommends hypo in place of gas chlorination for water systems using up to one-half million gallons per day (2 pounds of chlorine per day) and, in some instances, for systems using up to one million gallons per day. For larger water systems gas chlorination is more suitable. For a copy of the paper write to Proportioneers, Incorporated, 9 Coddington Street, Providence, R. I.

Tire Saving Rules—have recently been published by The B. F. Goodrich Co., of Akron, Ohio, in this company's "Farm and Home Almanac" produced for free distribution. One set of rules are devoted to passenger car tire maintenance, while another set applies to tires on tractors, implements, etc. Aside from these important and timely hints on tire maintenance and conservation, the "Goodrich 1942 Farm and Home Almanac" contains a variety of information of interest to almost everyone. Included is "17 Ways to Save Gas and Oil" and a page devoted to identifictaion of various insignia revealing the rank of officers in the several armed forces of the Nation. For a copy of the "1942 Farm and Home Almanac" write The B. F. Goodrich Co. (Public Relations Dept.), Akron, Ohio.

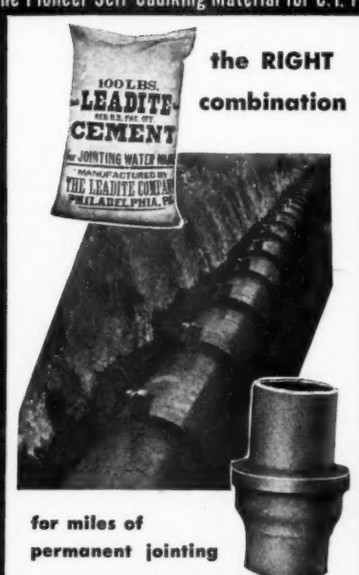
WATERPLUG

1. For control of water pressure when running or seeping through cracks and other defects in masonry.
2. For caulking and sealing around pipes or other appliances which pierce masonry walls of tanks, sludge basins or foundations.
3. WATERPLUG is prepared ready for use by the addition of mixing water only. It hardens quickly and is permanent.
4. WATERPLUG protects lead, copper, brass and other pipes, subject to corrosion from free alkali in cements.
5. Troublesome water problems can be solved quickly and permanently.

For free advice and methods of correction, please address

Standard Dry Wall Products, Inc.
BOX X NEW EAGLE, PENNA.

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe



the RIGHT combination

for miles of permanent jointing

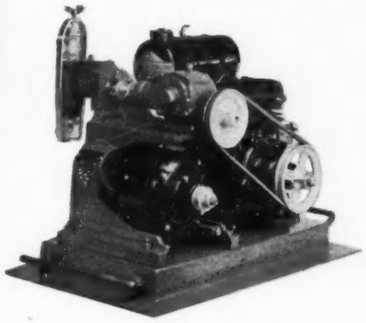
THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

EQUIPMENT NEWS

New Portable Hypochlorinator

Designed by Wilson Especially for Emergency Service



• Wilson Chemical Feeders, Inc., of Buffalo, N. Y., have recently developed a new Emergency Portable Hypochlorinator which has been especially designed for field use under *all* conditions.

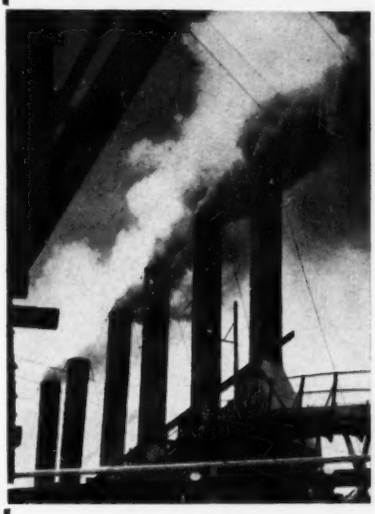
The new Hypochlorinator, with its electric and gasoline motor drive units, is extremely compact, its longest dimension being but 22 in., height only 17 in., and width 15 in.

The feeding unit is a standard Wilson "Pulsafeeder" of No. 1 size, which has a capacity for feeding at rates up to 600 lbs. of available chlorine per 24 hours against pressures up to 200 lbs./sq. ft. Or, since this portable unit is equipped with a duplex feeder, it may be used for simultaneously feeding two chemicals at one time. For instance, it can feed up to 300 lbs./day of chlorine through one pump and the second pump be employed for feeding ammonia solution at the same time.

A particularly interesting feature of Wilson's "Pulsafeeder" is that it is not necessary to allow the sludge to separate from hypochlorite solutions to be fed. Thus the batch of dry high-test hypochlorite can be mixed and fed immediately without the least delay. It handles all of the sludge and can feed solutions (suspensions) containing as much as 15 per cent available chlorine. This feature effects a saving in available chlorine as well as time and trouble of preparing sludge free solutions.

All of the above is made possible by the ingenious "Pulsafeeder" and the absence of packing glands, pistons or mechanically oscillated diaphragms. The "Pulsafeeder" is essentially a cylindrical chemical chamber constructed from a resilient compound. Surrounding the chamber is a fluid. Into the fluid chamber the drive piston is thrust and in turn the resilient feed chamber (tube) is compressed, thus forcing out a volume of chemical solution equal to

THE PROBLEM OF



PLANT OVERLOAD

IS EVER-PRESENT UNDER TODAY'S STRENUOUS PRODUCTION CONDITIONS

Solve this problem with

Ferri-Cl$_3$or

ISCO FERRIC CHLORIDE

THE MODERN AND EFFICIENT COAGULANT for precipitation and sludge dewatering.

INNIS, SPEIDEN & COMPANY
Established 1816
117 Liberty Street . . . . . NEW YORK
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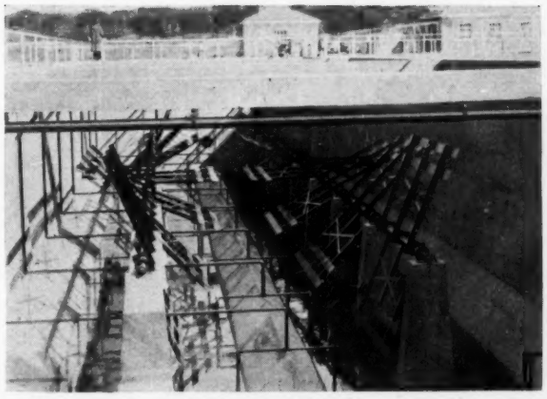
PADDLE AERATORS

SLUDGE PUMPS • FLOCERS • CONDITIONERS • MIXERS

SELF PRIMING CENTRIFUGAL PUMPS • HUMDINGER PUMPS



Carter Paddle Type Aerators installed at the Hackensack, N. J., activated sludge sewage treatment plant. Units designed to handle a maximum flow of 6.0 M.G.D. Plant constructed under P.W.A., by Industrial Engineering Co., in 1939. Lee Campbell, Cons. Engr. Arthur F. Lehmann, Operating Engineer.

RALPH B. CARTER COMPANY
NEW YORK OFFICE
53 PARK PLACE
HACKENSACK · NEW JERSEY

the exact displacement of the piston which compresses the surrounding fluid. On the back stroke the piston pulls the "Pulsafeed" tube back into normal shape and in so doing it sucks in another charge of chemical solution which is trapped therein by an intake valve of ingenious positive seating design.

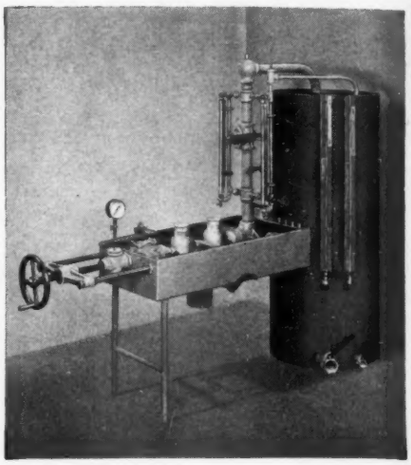
In addition to the No. 1 size Emergency Pulsafeeder, Wilson is offering a No. 2 size which has double the capacity of the No. 1—namely, up to 1,200 lbs. of available chlorine per 24 hours, or 600 lbs. of chlorine per 24 hours through one of the two pumps ("Pulsafeeders") and any other chemical desired through the twin pump.

For further details concerning the compact new Portable Emergency Hypochlorinator request Bul. No. 1, 1192, from Wilson Chemical Feeders, Inc., Buffalo, N. Y.

New Meter Tester by Pittsburgh-National

● This new meter prover for testing water meters, it has just been announced by Pittsburgh-National Meter Co., consists primarily of a cylindrical tank to which is attached a welded steel box holding the meter connections, and a new type of rate of flow indicating device.

The tank contains a division plate which separates it into two compartments, one holding 100 U. S. gallons and the other 10 gallons. Scales on the tank are adjustable for calibration and marked to read in percentages of error at the 100, 50, 10, 5 gallon and the 10, 5, 1 and ½ cubic foot points. Meters (up to and including the 2″ size) are



clamped in place by the conventional hand wheel and screw arrangement. There are two outlet pipes going to the measuring tank, one for each side of the dividing plate. Between the outlet pipe and the outlet of the meter are two rate of flow indicators, one which reads 1/20 G.P.M. to 15 G.P.M. and the other which reads up to 150 G.P.M. This prover will accommodate two 5/8″ and two 3/4″ meters at one time and take single meters up to a length of 25 inches.

For a more complete description request literature from Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Emergency Repair Fittings by Clow

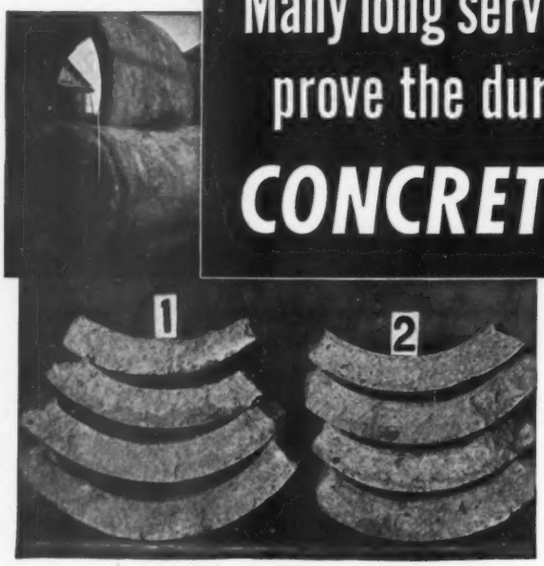
● James B. Clow and Sons of Chicago, with manufacturing plants in Chicago, Birmingham and Coshocton and Newcomerstown, Ohio, are offering Emergency Repair Fittings for all classes of C. I. pipe, in sizes from 3″ to 16″ inclusive.

The accompanying illustrations picture an assembly of three of these Clow National emergency fittings in their adaptation for bridging a gap in a pipe line, such as would be caused by an aerial bombardment, wash-out, etc.

The interesting feature of these fittings is the rapidity and ease with which they may be applied to a split pipe or a broken end. Being fitted with large rubber gaskets and follower flanges, a ratchet or box wrench is the only tool needed to apply these fittings, or the mechanical-joint pipe sections. Since no lead, jute or caulking is required the job can be done under water if need be, and under the minimum of light in the case of night repairs.

The "C-N" adapter sleeve has been

Many long service records prove the durability of CONCRETE PIPE



SAVANNAH, GA.— Concrete pipe sanitary sewer installed in 1870; condition excellent at inspection in 1927.

ST. PAUL, MINN.— Test specimens of 12-in. concrete pipe sanitary sewer in excellent condition in 1931 after 45 years.

Since the inception of sewerage, concrete pipe has been used for building sanitary, combined and storm sewers.

The concrete sewer pipe pictured here are veterans with service records up to half century and more. The sewers of which they are a part were found on inspection to be in excellent condition.

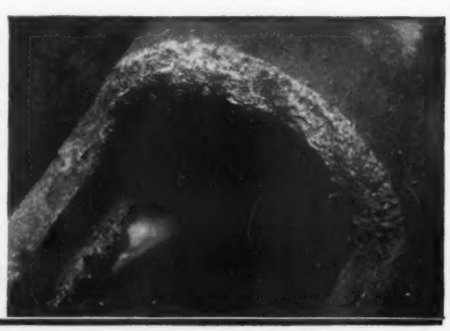
Durability records like these account for the vast scale on which concrete sewer pipe is in use throughout the world. And it is the best possible evidence that concrete pipe sewers, properly designed and constructed under the supervision of competent sanitary engineers, will serve your community for many decades with utmost economy.

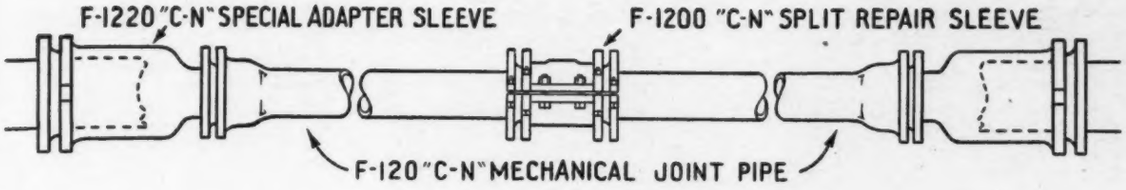
PORTLAND CEMENT ASSOCIATION
Dept. 3-29, 33 W. Grand Avenue
Chicago, Ill.

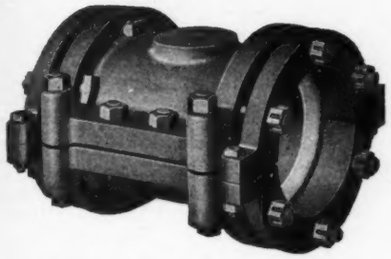
A national organization to improve and extend the uses of concrete...through scientific research and engineering field work.

●

MINNEAPOLIS, MINN.— 12-in. concrete pipe sanitary sewer installed in 1886. Found to be in excellent condition in 1933, after 47 years. Minneapolis has more than 35 miles of this old concrete pipe in its sewerage system today.







"C-N" Mech. Joint Split Sleeve

"C-N" Adapter Sleeve

designed and constructed after a pattern developed during British air-raid experiences. It is noted that the extra long hub provides much latitude in connecting to a very jagged end of a broken pipe. It is produced in two reducing sizes for the larger mains—namely 14 to 16″ reduced to 12″, and 8 and 10″ reduced to 6″, as the two most universally considered sizes.

A distinctive advantage of the "C-N" Split Repair Sleeves is the fact that these sleeves for 12″ pipe and under are fabricated to fit **any** class of C. I. pipe, making it necessary to carry on hand but one stock. The 12″ and smaller sizes will repair lengthwise or diagonal breaks or gaps up to 8 inches along the pipe. The larger size sleeves will take care of breaks or gaps running 17 inches along the pipe.

Almost needless to state, with the requisite number of lengths of the Mechanical Joint Pipe, two Adapter Sleeves and a single Split Sleeve, any length of emergency line or connecting link can be thrown in between ends of pipes in the same main, or two different mains may be thus inter-connected. It is also apparent that this type of emergency repair hook-up may have many other uses aside from its application as a war installation.

Not illustrated are the "C-N" Mechanical Joint Cutting-In Sleeves for installing Ts. or valves in pipe lines.

For the descriptive illustrated folder, presenting all of these emergency fittings for which there may be uses beyond those of a strictly defense nature, write James B. Clow and Sons, 201-299 Tolman Ave., Chicago, Ill.

BUY DEFENSE BONDS AND SAVINGS STAMPS

An Important Message from Stuart-Brumley Corp.

IN the interest of national defense, it has been pointed out that many box cars could be released for service if 30 tons were placed in a car instead of the minimum 20 tons.

During this crisis, we are asking consideration that a 30-ton car, or even a 40-ton car, be ordered instead of a minimum 20. This will release for other services many extra box cars.

STUART-BRUMLEY TELLS HOW TO CHOOSE THE *RIGHT* COAGULANT FOR YOUR PLANT.

BLACKALUM

$1.50 per cwt. f. o. b. Baltimore carload lots

A POWERFUL DEODORIZING AND DECOLORIZING COAGULANT

Activated Blackalum is an outstanding premium coagulant at $2.00 more per ton. It won't allow sludge to ferment in the basins. It is fast flocing over wide pH range. It is for the superintendent who will pay a little more to get complete satisfaction from winter coagulation worries.

ACTIVATED ALUM

$1.40 per cwt. f. o. b. Baltimore carload lots

ECONOMICAL CONTAINS HIGH ALUMINA

Standard Activated Alum is one of America's largest selling coagulants. It is the type preferred by the alert superintendent who wants maximum coagulation economy with greatest efficiency.

STUART-BRUMLEY CORP.
516 N. CHARLES ST. BALTIMORE, MD.

Stuart-Brumley Corp. offers better service . . . better products . . . and Activated Alum and Blackalum are better liked daily

Other products of Stuart-Brumley Corp.: Co-Res-Co Protective Coating for steel and cement; Palmer Filter Bed Agitators; Tate Cement Lining in Position; Champion Activated Carbon; Chlorinated Bleaching Clay.

Guard YOUR WATER SUPPLY SYSTEM

Beware of sabotage! Remember, in an emergency, your water system may save highly valuable materials, buildings and even lives.

Neglect is almost as destructive as sabotage. If your water supply system is not in tip top order, call in Layne and have necessary repairing and reconditioning done at once. Materials, except for strictly war work, may not be available later. Maintaining present equipment is real conservation.

If you require more water, arrange for additional wells and pumps without delay. Better call in a Layne engineer. He will cooperate with you in planning your additional water supply so as to use the minimum amount of materials essential to war work, yet give you an adequate, efficient and long lived installation. Layne wells and pumps are designed for your requirements regardless of size. They are noted for their high efficiency and trouble free service. They are serving all types of industries, municipalities both large and small, army and navy needs, training camps, flying fields and munitions plants.

Write, wire or telephone for further facts.

LAYNE & BOWLER, INC.
Memphis, Tennessee

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Layne-New York Co.....New York City.
Layne-Northwest Company.....Milwaukee, Wis.
Layne-Ohio Company.....Columbus, Ohio
Layne-Texas Company.....Houston, Texas.
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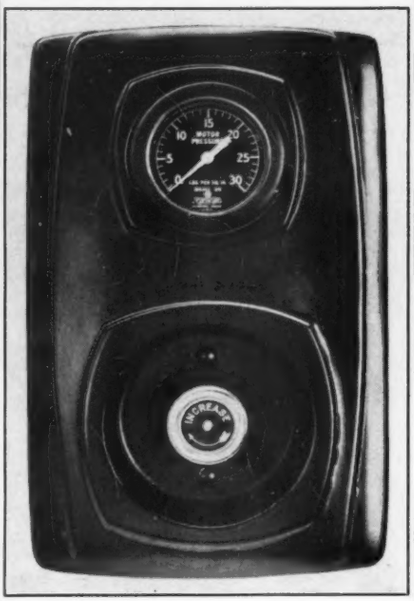
International Water Supply, Ltd...London, Ont.

WORLD'S LARGEST WATER DEVELOPERS

New Design for Remote Valve Control Unit



● A newly designed unit for the manual control of remote valves, dampers and other pneumatically operated equipment is announced by The Foxboro Co.

In appearance, the unit harmonizes with the rectangular case in which Foxboro recording and controlling instruments are now available. When the unit is flush-mounted, its front surface is only 7/16 in. from the surface of the instrument panel, and as its setting knob and pressure indicator are recessed, there are no protruding parts to suffer accidental bumps.

Specifically designed for dead-end service, the Remote Valve Control Unit will hold reduced pressures, dependably, to values with very narrow limits. Although most commonly used as its name suggests, it is equally useful in other applications, such as the setting of the control points of distant instruments or the adjustment of positioning or pressure-producing pistons, located in inaccessible points. It is practical for operation over distances as great as 1,000 feet.

The new Remote Valve Control Unit is illustrated and fully described in Bulletin A-276, of which copies will be sent on request to The Foxboro Co., Foxboro, Mass.

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INQUIRIES INVITED on all Problems of WATER TREATMENT

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

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607 COLUMBIA AVE.
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HYDRO-TITE

A DEPENDABLE self-caulking joint compound used to joint cast iron bell and spigot pipe. Much easier to use than lead and makes stronger, more flexible and tighter joints.

Employed on thousands of miles of pipe from 4" to 60". Write for our free trial offer.

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OVER 25 YEARS WITHOUT A FAILURE

NO. 2 at ORANGE TEXAS

• • •

Some time ago Lakeside Engineering Corp. sold Orange, Tex. one 36′ diameter Aero-Filter and at the present time is installing a second unit of 50′ diameter.

THE AERO-FILTER WILL FIT YOUR NEEDS. ECONOMICALLY, EFFECTIVELY. WRITE FOR FURTHER INFORMATION AND DATA SHEETS.

"Results Obtained by Excellent Distribution and *Not by Recirculation.*"

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LAKESIDE ENGINEERING CORP.

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Steel GASHOLDERS

Spherical or bullet types for efficient storage of digester gas under pressure in sewage treatment plants. Any size—any metal—designed to meet your specific requirements. An experienced P·DM engineer will gladly consult with you, without obligation.

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WITH THE MANUFACTURERS

Monsanto Awarded Coveted Navy "E" Pennant

• The following is the statement of the Secretary of the Navy which accompanied the flag of the Bureau of Ordnance and the coveted Navy "E" pennant awarded Monsanto Chemical Co. in recognition of this company's outstanding efforts and achievements in producing material vital to our national defense.

"It gives me pleasure to advise you that your organization has been chosen to receive the flag of the Bureau of Ordnance and the Navy 'E' pennant in recognition of your outstanding efforts in the production of ordnance material vital to our national defense. Recent events have made this award of even deeper significance than any which have been made in the past."

Amongst the crews of Uncle Sam's warships and naval planes the Navy "E" is one of the most coveted and respected honors the men of a gun turret or an entire fighting ship can win. It is a symbol, not of individual brilliance, but of championship teamwork that only long gruelling hours of actual practice can perfect.

The same tradition governs the award of a Navy "E" to an industrial plant—and Monsanto flies its pennant with justifiable pride.

Henceforth Its Infilco, Inc.

• International Filter Co. has changed its corporate name to "INFILCO Incorporated."

Organized 48 years ago, during the pioneering age of water purification, Infilco's early activities were in the design and devolpment of filters and filter plant equipment. Thirty years ago, the company started the manufac-

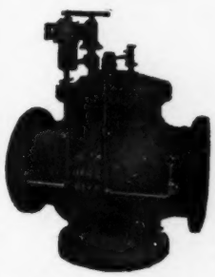
(*Continued on page* 84)

·1879·

ROSS AUTOMATIC VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

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SEWAGE AND SEWAGE TREATMENT

Specializing in Water Quality Problems

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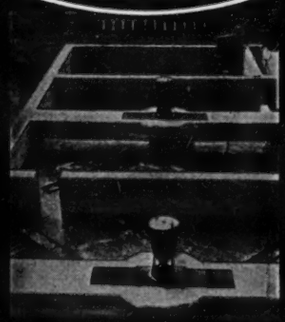

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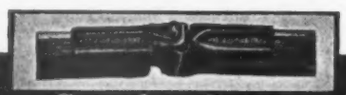

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Hays to Be Represented by Wyman in New England and Juline in New York State

● The Hays Manufacturing Co. of Erie, Pa., announces the transfer of Mr. Arthur R. Johnson from the position of sales represetnative for northern New York State and New England, to the production department of the company's plant in Erie. Mr. Johnson's thorough knowledge of field conditons will be fully utilized in his new duties. The New England territory will be covered by Mr. George S. Wyman of the Hays' New York City office, and the northern New York State territory by Mr. Richard Juline, the company's Central District representative.

Morris Directors Elect Stuart Saks President

● Directors of Morris Machine Works, Baldwinsville, N. Y., manufacturers of centrifugal pumps, hydraulic dredges and steam engines, announce the election of Stuart J. Saks as President of the company.

Mr. Saks is a graduate of Syracuse University; and following an extensive sales and management experience, has been associated with Morris Machine Works for the last two and one-half years as Assistant to the President.

Pomona Pump Acquires Westco

● Pomona Pump Co., said already to be the largest exclusive manufacturer of vertical pumps in the world, has recently acquired Micro-Westco, Inc., pump manufacturers of Bettendorf, Iowa.

Plant and equipment and personnel will be transferred to Pomona's No. 2 plant at St. Louis, Missouri, where the manufacture of the entire line of the well known Westco pumps will be continued and distribution made through the same national organization which

(Continued next page)

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The Perfected Method for Making SEWER PIPE JOINTS OF CEMENT

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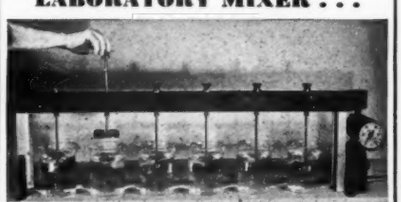

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has carefully been built up by Micro-Westco during the past twenty years. Mr. Leon F. Wernentin, former Manager, and Mr. Ivor G. Morgan, former Sales Manager, of Micro-Westco, continue in the same capacities with the new Pomona Pump Co.—Westco Division at 4301-7 South Spring Avenue, St. Louis, Missouri.

The addition of the well known boiler feed systems, condensation return units, turbine type water systems, side suction centrifugal pumps with renewable liners, and cellar drain units rounds out the line of Pomona deep well, low lift, industrial, mine and municipal pumps, to which has been added in the last two years the Pomona Little Chief turbine and the Pomona deep and shallow well jets.

The announcement of the purchase of Micro-Westco was made by Mr. George A. McKenna, President of Pomona Pump Co.

Mathieson Magnesium a War Product

More Chlorine to be Produced Simultaneously

● In accordance with a contract which has been signed by the Defense Plants Corporation and The Mathieson Alkali Works, Inc., work on a new plant for the production of metallic magnesium and chlorine will be begun immediately, according to an announcement made by E. M. Allen, President of Mathieson.

The plant, which will be located at Lake Charles, La., and will cost approximately $22,500,000, will be owned by the Defense Plants Corporation. It will be operated by Mathieson and will produce about 36,000,000 pounds of magnesium a year by a process developed by Mathieson.

This process differs from other processes for making magnesium electrolytically, in that it does not consume chlorine but produces it in such concentration that it can be collected and liquefied.

The magnesium produced by the Mathieson process is obtained from dolomite, which will be shipped from nearby quarries. This material is calcined, using locally produced natural gas for the purpose, and the resulting oxides of calcium and magnesium are treated with calcium chloride, a by-product of the process by which soda ash is made at one of the Mathieson plants, also located at Lake Charles. The mass is then treated with carbon dioxide, obtained from the calcination of the dolomite, which converts the calcium into the insoluble carbonate, leaving magnesium chloride.

The magnesium chloride, after being concentrated, is electrolyzed in a new type of cell, which was independently developed by Mathieson in conjunction with The Consolidated Mining and Smelting Company, of Canada, Ltd. The products are metallic magnesium and chlorine, both of which are essential war materials.

Where Is The Largest Rotary Distributor Installation in the U. S.?

Dayton, Ohio, with twenty 165'-diameter P.F.T. units — one of dozens of installations pictured and described in Bulletin No. 213.

The engineering data it contains shows why P.F.T. Rotary Distributors are by far the most widely used. Send for a copy.

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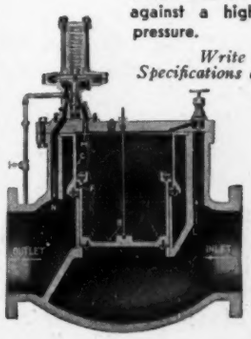

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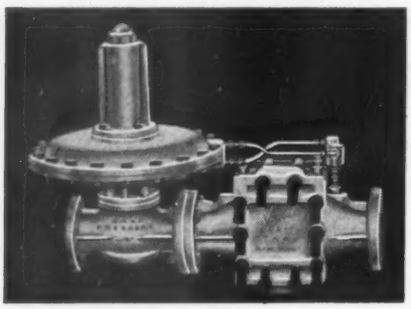

Fig. No. 440. "Varec" Approved Pressure Relief and Flame Trap Assembly maintains a predetermined back-pressure throughout the system, passing surplus gas to the burner. It stops flame propagation. Non-corrosive aluminum construction.

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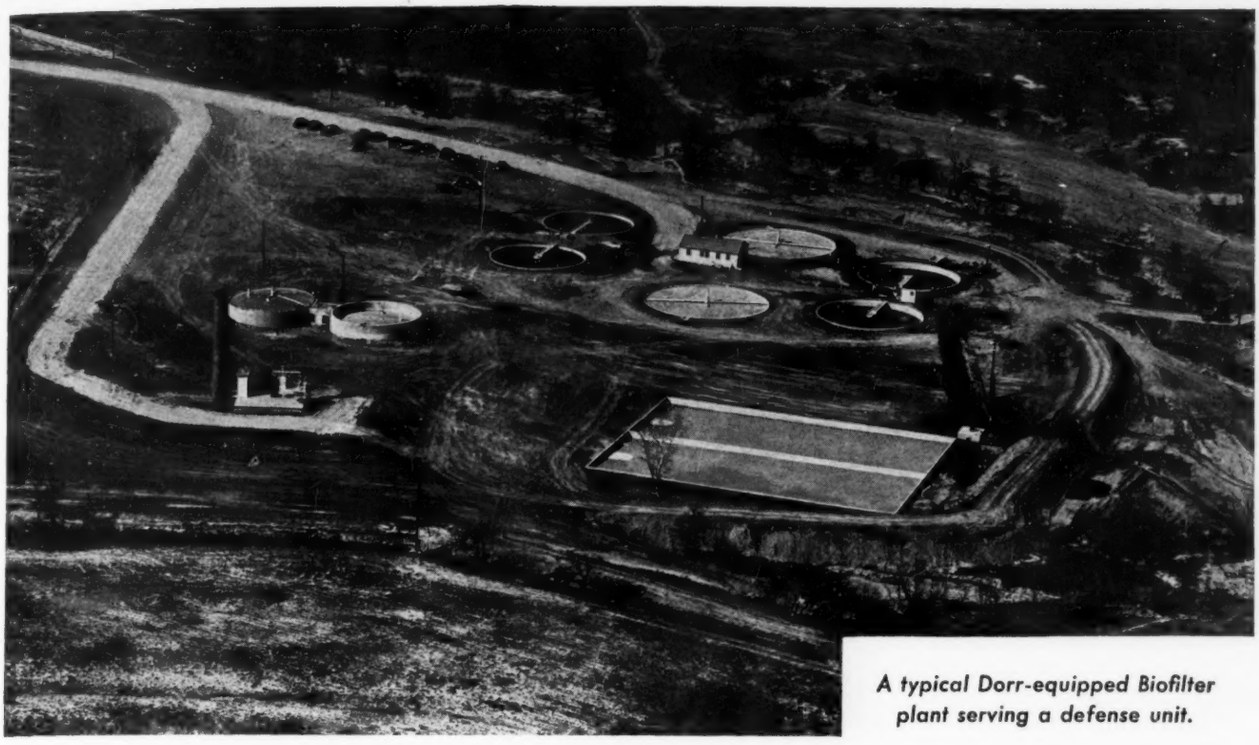

A typical Dorr-equipped Biofilter plant serving a defense unit.

FOR OUR DEFENSE FORCES

★ During 1941, about 92 percent of our work was for the Defense Program. This has meant the equipping of many sewage and water plants for the defense forces—the providing of better sanitation for over a million men.

We enter 1942 with an understanding of exactly what is required for each type of defense plant. That the situation has been diagnosed correctly is shown by the successful operation of these plants, most of which have exceeded in practice the results contemplated during the blue print stage.

If you are a designing engineer, active in defense plant projects, you will be interested in the following list, showing the types of plants we have been equipping, and the units we have been recommending in each case—

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Design Population—1000-5000
Type Treatment—Trickling filter or Biofilters (single stage)
Dorr Equipment—Clarigester, Distributor, Secondary Clarifier

ARMY CAMPS AND NAVAL BASES

Design Population—10,000-40,000
Type Treatment—Biofiltration—single or two stage
Dorr Equipment—Clarifiers, Distributors, Multdigestion Systems, Detritors

INDUSTRIAL CITY EXPANSIONS FOR DPW

Design Population—all up to several hundred thousand
Additions to existing plants—
- Dorrco Clariflocculators—for better sedimentation
- Dorrco Monorakes—for mechanizing existing rectangular plain basins
- Biofiltration Systems—for better trickling filter treatment

Entirely New Plants—
- Small—same as Air Bases and Ordnance plants at left
- Larger—same as Army Camps and Naval Bases at left

This is the first of a series of ads on the use of Dorr equipment and services at sewage and water treatment plants serving our defense forces. Subsequent ads will take up each particular type of plant in detail.

★ May we talk Defense Program sanitation with you—facts, figures and costs on what has been done in 1941 and can be done better in 1942?

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ADDRESS ALL INQUIRIES TO OUR NEAREST OFFICE

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Wallace & Tiernan field representatives are advising on operating practices that raise safety standards by providing closely controlled residuals throughout the distribution system.

★ ★ ★

Is your equipment operating at full efficiency? It may be well to have it checked by a skilled W&T service man. With the best equipment in the best condition, you're set for any eventuality.

HERE'S HOW W&T SERVICES CAN HELP ASSURE SAFETY

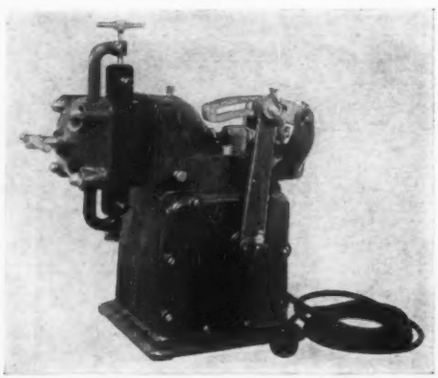
The full advantages of a water supply protected by Wallace & Tiernan chlorinators, with the backing of W&T service assistance, were never greater than they are today.

Because W&T field men know chlorination practice so thoroughly, they can help you to raise safety standards, to meet increased demands, to prepare for any emergency. And because these men make it a point to keep informed of your own *local* situation . . . the characteristics of the water . . . the treatment routine . . . the conditions you have to meet . . . they can work with you promptly and expertly whenever the need arises.

Whatever the problems of the moment arising from the war situation, from abnormal water levels or demand, or from new public health regulations affecting your community, you'll find Wallace & Tiernan ready to go into action to help you. Write today for details.

★ ★ ★

W&T Hypochlorinators safeguard small public water supplies, supplies for camps, industrial plants, stand-by sources and the like. They can provide vitally needed protection to well supplies previously unchlorinated. SA-127



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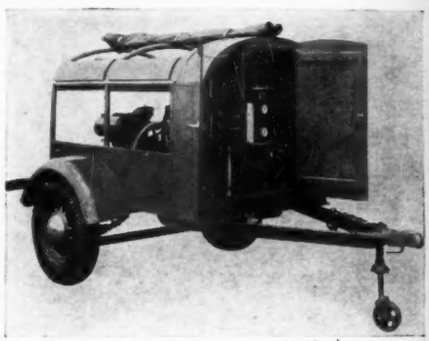

This new emergency chlorination trailer uses the W&T vacuum principle in a new rugged-service construction. Provides self-powered solution feed up to 300 lb. chlorine per day.

WRITE TODAY FOR THESE AIDS TO EXTRA SECURITY

W&T Technical Publication 228 describes the new W&T Emergency Chlorination Trailer in detail . . . gives specifications.

W&T Technical Publication 225 gives a 7-point plan for building a sound defense for your water supply system, including data on emergency chlorination.

As in past emergencies W&T is putting forth every effort to meet the demands of the situation with standard Visible Vacuum Chlorinators or special equipment for any water treatment need. Valuable assistance on your specific problems is available without obligation. Just call your local W&T Representative or write direct to: